SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Draft Staff Report

Proposed Rule 1127 – Emission Reductions From Livestock Waste

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EXECUTIVE SUMMARY

The purpose of Proposed Rule (PR) 1127 is to reduce ammonia, volatile organic compounds (VOC) and particulate matter under 10 microns (PM10) from dairies. PR1127 is designed to implement the Air Quality Management Plan (AQMP) control measure WST-01 and establish BACM requirements for dairies called for by SB700.

The South Coast Air Quality Management District (AQMD) exceeds state and federal ambient air quality standards for PM10 (fine particulate matter less than 10 microns in diameter) and ozone. Since 1994, the AQMD prepared and adopted AQMPs that have included a control measure (WST-01) to reduce ammonia, VOCs, and PM10 from livestock waste. The control measure was updated in the 1997 AQMP, the 1999 AQMP/Ozone AQMP revision and the 2003 AQMP State Implementation Plan (SIP). The control measure calls for a 50% reduction in ammonia and a 30% reduction in VOC emissions from 1997 AQMP base year (1993) levels by 2006. California SB 700, adopted in September 2003, removes the exemption for agricultural sources from regulatory requirements and requires that for each serious PM10 non-attainment area, districts must adopt best available control measures (BACM) for agricultural stationary sources of air pollution by July 1, 2005, with implementation no later than July 1, 2006.

The local dairy industry is unique in many ways. Almost all dairies use a dry-lot corral system, as opposed to the more prevalent flushed lane system used elsewhere in California and the nation. Increasing urbanization is inducing many farmers to relocate; the same process occurred in the 1970s when dairies moved from Los Angeles County to San Bernardino and Riverside counties. By 2015 or 2020, the total number of dairy cows will probably reduce by half from mid-1990 levels. Reduced cattle populations will reduce dairy manure emissions. In addition, stricter water quality regulations adopted in 1999 have changed the dairies' manure handling and land spreading operations. Some of the water regulations also reduce manure emissions.

As noted in the 2003 AQMP control measure WST-01, the 1997 AQMP set a "target" level of remaining emissions from dairy operations; 50% ammonia reductions and 30% VOC reductions from the 1993 base year emissions by 2006. Adjusted for the latest emission factors and emission methodologies, the 2003 AQMP baseline emissions for VOCs, ammonia, and PM10 from dairy manure are approximately 10.0, 25.9, and 1.3 tons per day, respectively, in 1993. In the absence of PR1127 but accounting for emission reductions from dairy relocations and water quality regulations enacted in 1999, the 2010 dairy manure emissions are estimated to be 4.5 tons per day VOC, 12.7 tons per day ammonia, and 0.8 tons per day PM10.

Facilities affected by the proposed rule include agricultural operations or facilities that are directly related to raising cows and/or producing milk from cows for the purpose of making a profit or for a livelihood, i.e., dairy, heifer and calf farms. PR1127 will also affect manure processing operations, such as composting facilities and anaerobic digesters. PR1127 would require Best Management Practices (BMP's) on dairies, including dust prevention and more frequent manure removal. PR1127 would establish requirements for alternative manure composting operations that allow manure composting in in-vessel systems that may not meet

all the requirements of Rule 1133.2 for co-composting operations. It is proposed that farms that have fewer than 50 cows would be exempt from PR 1127 requirements.

With the implementation of PR1127 and accounting for the impact of dairy relocation and water quality regulations, remaining emissions in 2006 are 10.7 tpd ammonia and 3.8 tpd VOC; the 2003 AQMP target levels are 13.0 tpd ammonia and 6.7 tpd VOC. Thus, the 2003 AQMP control requirements of WST-01 will be exceeded with the implementation of PR1127. SB700 BACM requirements for dairy and related operations will be met through implementation of existing Rule 1186, "PM10 Emissions from Paved and Unpaved Roads, and Livestock Operations," adopted in 1997 and amended in 2004, and adoption and implementation of PR1127.

Remaining emissions in 2010 after the implementation of PR1127 are estimated to be 3.3 tons per day VOC, 9.4 tons per day ammonia, and 0.8 tons per day PM10. Reductions from the impact of PR1127 alone (separate from reductions due to dairy relocation and the air quality benefit of water quality regulations) are 3.3 tpd ammonia and 1.2 tpd VOC in 2010. The cost effectiveness for PR 1127 is $5,800.per ton of VOC reduced and $2,070 per ton of NH3 reduced and $2,070 per combined ton of NH3 and VOC reduced.

BACKGROUND AND LEGAL AUTHORITY

The AQMD is the local government agency responsible for air quality assessment and improvement in Orange county, the non-desert portions of Los Angeles and San Bernardino counties, and most of Riverside county. AQMD jurisdictional boundaries include all of the Basin and portions of the Salton Sea Air Basin (SSAB). AQMD air monitoring indicates that these air basins exceed State and federal health-based air quality standards for PM10 and ozone. Accordingly, the U.S. EPA has designated both the SCAB and the SSAB as serious non-attainment areas for PM10 and extreme non-attainment for ozone. Under the federal Clean Air Act, the AQMD is required to attain the PM10 standards for both of these air basins by 2006 and the ozone standard by 2010. Ammonia is a precursor of PM10, particularly aerosol ammonium nitrate and ammonium sulfate. Volatile organics compounds (VOC) are precursors to ozone. Livestock waste produces appreciable amounts of VOC and ammonia emissions.

Under the State law, the AQMD is required to adopt an Air Quality Management Plan (AQMP) that identifies a control strategy to demonstrate compliance with all State and federal ambient air quality standards.[1] To address these State and federal mandates, the 1994, 1997 AQMPs, the 1999 amendment to the 1997 ozone SIP, and the 2003 AQMP included control measure (WST-01) for the control of ammonia and VOC emissions from livestock operations. PR1127 is designed to implement the 2003 AQMP control measure WST-01.

Air Quality Regulations

AQMD Rule 1186, PM_{10} Emissions From Paved and Unpaved Roads, and Livestock Operations reduces the amount of particulate matter entrained in the ambient air as a result of

[1] California Health and Safety Code Section 40460(a)

vehicular travel on paved and unpaved public roads and at livestock operations. Rule 1186 restricts the times during which a dairy operator can grind hay. The restriction is dependent on extent of visible emissions. Also, livestock operations are required to control entrained road dust from unpaved access roads on the dairy operation.

The 2003 AQMP includes control measure WST-01 as part of a comprehensive program to reduce sources of PM10 and ozone precursor emissions, e.g. ammonia and VOCs. The emission reductions can be achieved by the relocation and the resulting decrease in cow population, air quality benefits associated with water quality regulations, and by proposed control methods. The 2003 AQMP (as originally stated in the 1997/9 AQMP) establishes a "carrying" capacity (or "target") for dairy emissions. This target is set to ensure attainment of the PM10 standards, as determined by the attainment demonstration. Emission reductions from livestock relocation outside of the Basin will be counted toward the WST-01 goal of a 50% ammonia and 30% VOC emission reduction from the 1997 AQMP base year emissions (base year = 1993). However, it is becoming apparent that the 2006 emission reduction target can not be met with relocations alone. The anticipated emission reduction shortfall and the Basin's severe air pollution problem relative to ozone, PM10 and PM2.5 necessitate further controls of ammonia and VOCs from dairy operations and livestock facilities. Control options described in the 2003 AQMP include altering livestock feed to reduce nitrogen content in resulting manure (urine and feces), removal of manure from the facility in a timely manner, storage of manure under conditions that produce less ammonia, promotion of aerobic rather than anaerobic conditions in the feed yard floors, corrals and manure stockpiles, and/or the application of enzymatic, pH adjusting and/or microbial solutions to the manure to reduce emissions.

Prior to the approval of SB700 in September 2003, California state law exempted equipment used at agricultural facilities from the permit system of local air pollution control districts. Equipment used at agricultural facilities represents a significant source of air pollution throughout the state. With the exemption from permitting, agricultural facilities were not included in the state's Title V permitting program required by the Federal Clean Air Act. The United States Environmental Protection Agency (USEPA) proposed disapproving the state's Title V permitting program because of the exemption and the significant source of air pollution that agricultural operations represent. To avoid federal sanctions, on September 22, 2003, Governor Davis signed SB700, which revised state law to remove the agricultural permitting exemption. SB700 was adopted to harmonize state and federal permitting requirements and to recognize the contribution to the air pollution problem that agricultural operations represent. In addition to correcting the deficiencies cited by USEPA, SB700 mandates new permitting and pollution control requirements for agricultural sources in California and requires that agricultural sources be treated similar to other sources of air pollution.

SB700 requires each district that is designated a serious federal non-attainment area for an applicable ambient air quality standard for PM as of January 1, 2004, to adopt, implement, and submit for inclusion in the state implementation plan (SIP), a rule or regulation requiring BACM and Best Available Retrofit Control Technology (BARCT) for agricultural practices at agricultural sources of air pollution to reduce air pollutants from those sources for which that technology is applicable for agricultural practices by the earliest feasible date but no later than January 1, 2006. SB700 also requires each district subject to those requirements to comply with a schedule for public hearing, adoption, and implementation of the final rule.

Adopted Rule 1186 and PR1127 would implement BACM at dairies as required by SB700. Permitting requirements for equipment at dairies will be addressed through other AQMD actions. Other SB700 requirements, such as whole farm permits, emission reduction permits for Large Confined Animal Farms (as defined by SB700) and BACM requirements for poultry and other livestock operations, will be addressed in future AQMD rulemaking.

Water Quality Regulations

In the Chino Basin, high concentrations of animals per acre of land have resulted in the generation of large volumes of manure, (e.g. more than 1.3 million tons of manure was produced in 2002). Historically, the manure has been stored in the corrals, stockpiles and to a much smaller extent, in the holding ponds. The density of the livestock and the location of the dairies have limited the manure disposal options. Few dairies have had pasture land on which to spread the manure and there were only a few local composters. Due to these limitations, the majority of the manure was stockpiled at the dairy, hauled off site, stored in stockpiles or land applied to cropland as fertilizer. Animal waste in rainfall runoff from livestock operations in the Chino Basin and the San Jacinto Basin has caused groundwater pollution and impacted the quality of the area waterways, including the Santa Ana River, Prado Basin, San Jacinto River, Canyon Lake and Lake Elsinore. Percolation of rainfall and runoff through corrals and drainage from stockpiles contaminates the groundwater with nitrates and total dissolved solids (TDS). Therefore, proper management of wastes from dairies and other confines animal feeding operations (CAFOs) is necessary to protect the surface and groundwater.

Based on analysis of the 2002 SARWQCB Annual Report, 314 dairy operations submitted annual reports to the Santa Ana Regional Water Quality Control Board. The majority of the Santa Ana and San Jacinto watersheds, which comprise the SARWQCB jurisdiction, lie within the Basin. All of the dairy operations under the SARWQCB jurisdiction are located within the Basin. The geographical location of the watersheds and dairy operations are shown in Figure 1. In 2002, the dairy operations contained approximately 253,000 lactating (milking) cows (CDFA). Two hundred and seventy-three dairy operations are located within the Chino Basin, 38 are within the San Jacinto Watershed and 3 are located in the Upper Santa Ana Region. In 2002, 1.3 million tons of manure was reported in the manure manifests submitted to the SARWQCB.

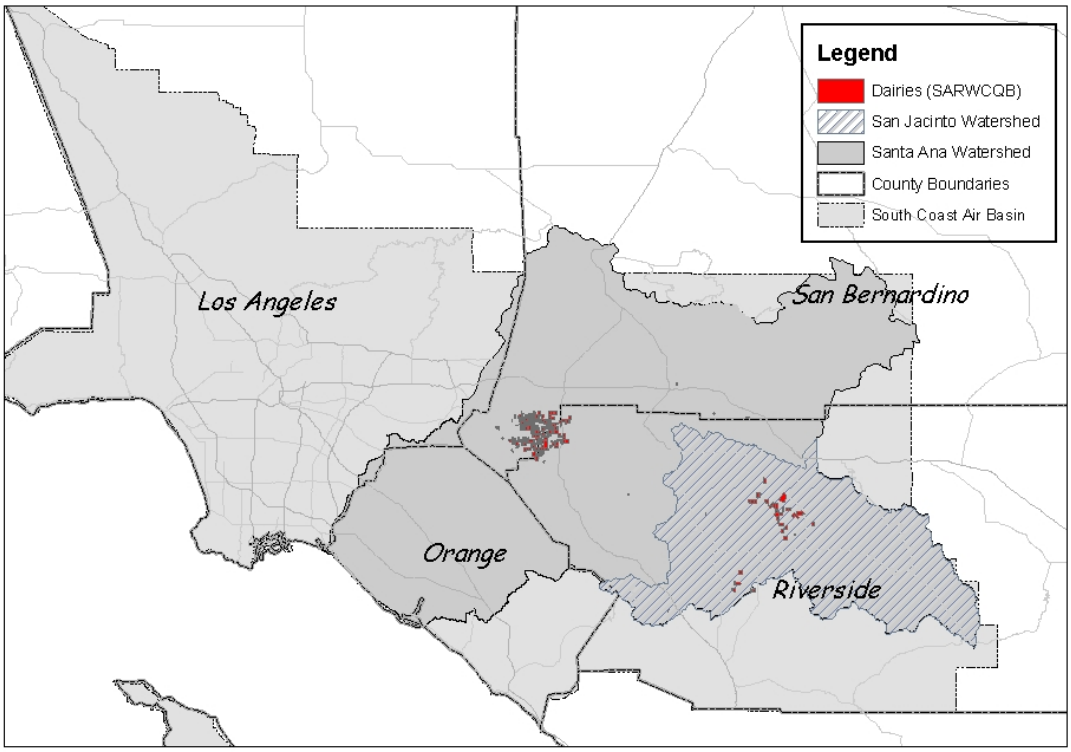

Figure 1: Santa Ana and San Jacinto Watershed Locations (SAWPA)

From 1972 to 1994, the SARWQCB regulated the dairies by issuing individual waste discharge permits. In 1994, the SARWQCB adopted a General Waste Discharge Requirement, Order No. 94-7, for concentrated feeding operations, including dairies, in the Santa Ana Region. At the time, two desalters were scheduled to be built in the Chino Basin as well as the operation of a Chino Basin Co-composting facility. These facilities were expected to reduce the salt and nitrate load from the Chino Basin. However, only one desalter has been built and the co-composting facility did not remove the expected amount of manure from the SAWCQB Region. As a result, the salt load in the SARWQCB Region was not significantly reduced. During this time period (1994 – 1999), the dairies continued to stockpile the manure at the dairies, and land apply manure to local farm land.

The SARWQCB has since re-evaluated the dairy and other AFO regulations in the SARWQCB Region and developed Order No. 99-11. This order complies with the federal Clean Water Act (CWA), which states that all concentrated feeding operations are point sources and are subject to NPDES permits. (The SARWQCB has deemed that all dairies, calf nurseries and heifer ranches in the SARWQCB Region are CAFOs and are subject to NPDES requirements). Order No. 99-11 regulates the storage of manure, discharge of manure and application as fertilizer in the Chino Basin and requires that the dairy operations comply with the following control options in order to minimize ground water contamination:

- Clean corrals and remove stockpiled manure at least twice a year (every 180 days)

- Two Clean Days per year – free of stockpiled manure
- Application of manure as a fertilizer in the Chino Groundwater Basin is prohibited (with exemptions)

In order to comply with Order No. 99-11, the dairies are required to prepare a manure manifest of the manure hauled away and submit the manifest with the annual report, in accordance with the SARWQCB annual report requirements. Compliance with the SARWQCB, Order No. 99-11, is factored into the emission reduction analysis and forms the basis of the PR1127 requirements.

In January 2003, the U.S. Environmental Protection Agency (EPA) revised the regulatory requirements for concentrated animal feeding operations (CAFOs) under the Clean Water Act. The rule ensures that CAFOs take appropriate actions to manage manure effectively in order to protect the nation's water quality. The rule revision strengthens the existing regulatory program for CAFOs. The rule requires all CAFOs to apply for a National Pollutant Discharge Elimination System (NPDES) permit. The new NPDES permit requirements pertain to beef, dairy, swine, veal calves and poultry CAFOs. In addition all CAFOs covered by NPDES permits are required to develop and implement a nutrient management plan (NMP). The nutrient management plan identifies manure management practices necessary to implement the effluent limitations guidelines and any other requirements in the permit. The nutrient management plan would include requirements to land apply manure, and process wastewater consistent with site specific nutrient management practices that ensure appropriate agricultural utilization of the nutrients.

Dairies within the SARWQCB jurisdiction are required to either submit a engineered waste management plan (EWMP) or a nutrient management plan (NMP). EWMP's are required for dairy operations that do not have the capacity for land application of manure within their dairy operation.

Federal and state programs exist that aid the agricultural industry with environmental requirements. The federal, Environmental Quality Incentives Program (EQIP) is funded through the Farm Bill and is administered by the Natural Resources Conservation Service (NRCS). EQIP is a voluntary program that provides assistance to agricultural producers to meet Federal, State, tribal and local environmental requirements.

The California Dairy Quality Assurance Environmental Program (CDQA) is administered through the University of California at Davis, cooperative extension programs and helps California dairy producers understand and meet federal, state, regional and local requirements for manure and water quality. An air quality component is currently being developed and will be added to the CDQA program.

INDUSTRY PROFILE

A dairy farm or facility is an agricultural operation directly related to the raising cows or producing milk from cows for the purpose of making a profit or for a livelihood. The USDA reports that there were 105,250 milk production operations and 9.2 million dairy cows in the United States in the year 2000. California produced 19.2 percent of the milk in the United States and the state is ranked number one for milk production in the country. On average,

California had 1.5 million dairy cows, 2,195 dairies in the year 2000. In California the average number of cows per dairy was 696 compared to the national average of 88. In Riverside and San Bernardino the average number of cows per dairy are 1092 and 842 respectively. Dairying practices differ throughout the state, country and world. In the San Joaquin Valley and northern California the majority of the dairies are flush lane operations. The manure in the milking parlors and free stall barns are flushed with recycled lagoon water into the lagoons. Waste from the lagoons is land applied as a nutrient source to local farmland. Most dairy farms in the Basin are "dry lot corral" dairies. Dairy cows live in open corrals, with feed lanes usually along one side of the corral. Manure is generally cleared from the feed lane into the corral, and then periodically removed from the corral, either to on-site stockpiles or off-site. Current water quality regulations require clearing of on-dairy manure twice a year.

Local Dairy History

Historically, from the 1950's until the early 1970's, Los Angeles and Orange counties represented the center of dairy operations in Southern California. The city of Cerritos, originally named Dairy Valley, was one of the large dairy centers. Dairy Valley was the home to 100,000 cows on more than 400 dairies and 106,300 chickens on licensed poultry farms. Urban crowding, increased odor and nuisance complaints, traffic and drainage problems caused the dairies to move eastward to the San Bernardino Agricultural District or "Dairy Preserve".

During the 1930's the Chino Valley "Dairy Preserve" in San Bernardino county contained 117 dairies and 7,600 cows. The herds were small and ranged from 15 to 25 cows with family members supplying practically all the labor. By 1950, the number of cows in Chino Valley had doubled, but the dairy numbers had declined to 99. Between 1950 and 1970 many dairies sold their cows and milk quota because of the favorable prices resulting from the statewide marketing pool. However, other dairies increased their herd size for maximum use of their facilities and equipment. This resulted in an overall increase in the number of dairy cows in both San Bernardino and Riverside Counties. A large part of the increase was a result of the relocation of dairies from the Los Angeles and Orange County metropolitan areas to the Chino area. As dairying became more specialized, the average herd size increased. In 1991 there were 349 dairies. In 2002, there were 314 dairies.

The high concentration of animals per acre of land in the Chino/Ontario area results in a large volume of manure stored in corrals, stockpiles and to a much smaller extent, holding ponds. This high density of livestock, as well as the location of dairies, limits manure disposal options. Few dairies have pastures on which to spread the manure, and there are only a few local composters that use the manure. Large quantities of manure are trucked to other areas of the Basin and to areas outside of the Basin, such as the Imperial County or San Joaquin Valley, for processing as fertilizer. In October of 1999, the Santa Ana Regional Water Quality Control Board (SARWQCB) approved comprehensive National Pollutant Discharge Elimination System (NPDES) regulations for local dairies. The NPDES regulates the removal of manure from dairies and the storage of stockpiles of manure. Under these regulations, manure must be removed from the dairies twice a year (approximately every 180 days). This includes the scraping of corrals and removal of stockpiled manure. Storage of manure in stockpiles promotes anaerobic conditions and the generation of by-product gases.

In 1999, the Local Agency Formation Commission granted the City of Chino annexation rights to 7,000 acres and the City of Ontario to annexation rights to 8,600 acres of previously dedicated agricultural (e.g. dairy) land. Due to urbanization and economic reasons, some dairy and other livestock operations are leaving the Chino/Ontario area and are relocating to other areas such as the San Joaquin Valley, the northwestern United States, and Texas.

Current Local Dairy Situation

The Chino/Ontario area, which includes the former Agricultural Preserve, is a 15,000 acre area in southwestern San Bernardino and Riverside Counties which contains approximately 300 dairies with over 250,000 cows, resulting in one of the densest dairy cow populations in the country. The resulting manure (feces and urine) from these dense herds of cows produces large amounts of ammonia in a relatively small area. This ammonia is a key contributor to ammonium nitrate; in peak PM10 areas a preliminary modeling study indicated that ammonia reductions in the former Agricultural Preserve area would lead to significant decreases of ammonium nitrate in peak PM10 areas (SCAQMD, 1993). (Other contributors to PM10 are NOx and SOx emissions from upwind mobile and stationary sources.) Other livestock facilities such as poultry and horse ranches are found to a much lesser extent in the Basin. It should be noted that livestock facilities are also present in other areas of the Basin, generally toward its eastern and northern boundaries. The spatial distribution of dairy and poultry operations is shown in Figure 2.

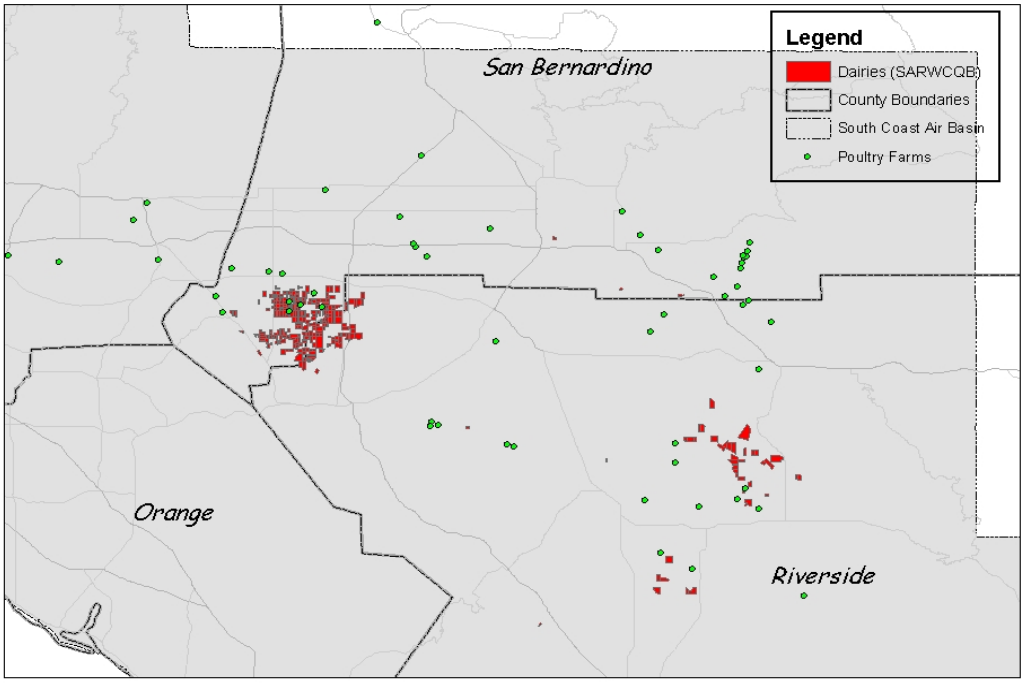

Figure 2: Distribution of Poultry and Dairy Operations in the Basin

According to the Santa Ana Regional Water Quality Control Board's (SARWQCB) annual inventory of the dairy industry, in 2002 there were 314 dairies in the Basin with 204,846 milking cows, 36,201 dry cows, 75,582 heifers and 77,320 calves ("Results of 2002 Annual Report of Animal Waste Discharge Analysis", May 8, 2003, SARWQCB). (Calves are cows up to 12 months old, heifers are cows from 12 to 24 months old, or until first breeding, milking cows are adult cows that are lactating and dry cows are adult cows that are not milked, generally 45 to 60 days before giving birth.) Most of the dairies are located in the Chino-Ontario-Norco region, with the remaining dairies in the San Jacinto watershed region (eastern Riverside County, near Moreno Valley-Lake Elsinore-Hemet) and Upper Santa Ana.

The Chino-Ontario-Norco region is a 15,000 acre area in southwestern San Bernardino and Riverside counties, and has one of the densest dairy cow populations in the country. The resulting manure from these dense herds of cows produces large amounts of ammonia in a relatively small area.

Most dairy farms in the Basin are "dry lot corral" dairies. Dairy cows live in open corrals, with feed lanes usually along one side of the corral (Figure 3-1).

FIGURE 3-1: Cows at the FeedLane

Manure is generally cleared from the feed lane into the corral (Figure 3-2) and then periodically removed from the corral to on-site stockpiles, to off-site locations or spread on cropland at the dairy as a soil amendment.

FIGURE 3-2: Cows at the Watering Trough in the Corral

The high concentration of animals per acre of land results in a large volume of manure stored in corrals and stockpiles. Because most dairy operations are clustered in a relatively small area with a high density of dairy livestock herds, substantial amounts of manure are produced in a concentrated area.

The Chino Basin is considered to have the highest concentration of dairy animals in the world within an area of less than 50 square miles. Stockpiles of manure and the application of manure to the ground in the Chino Basin have resulted in substantial groundwater pollution, specifically from total dissolved solids (TDS) and nitrate. Contaminated groundwater in the Chino Basin also adversely affects the quality of the Santa Ana River because groundwater from the Chino Basin contributes to the surface flow of the Santa Ana River.

Beginning in 1992, and continuing through 1994, the SARWQCB regulatory approach for concentrated animal feeding operations (CAFOs) was to issue individual waste discharge requirements for each animal feeding operation. Changes in the location, size, number of animals, or operator of these facilities were frequent and necessitated continually rescinding existing waste discharge requirements and issuing new requirements. As a result, in 1994 the SARWQCB adopted Order No. 94-7, which outlined "general" waste discharge requirements for all CAFOs, including non-dairy related facilities. SARWQCB Order No. 94-7 expired in March 1999.

In 1999, the Santa Ana Regional Water Quality Control Board enacted Order No. 99-11 (NPDES No. CAG018001). Order No. 99-11, among other things, prohibits the stockpiling of manure at a dairy for more than 180 days and restricts land spreading of manure on croplands within the Santa Ana Region. Except for a small amount of manure spread on cropland at the dairy, manure is currently hauled from the dairies to composting facilities or applied to cropland. Before Order No. 99-11, most manure was spread on local croplands in

the Santa Ana and San Jacinto regions. In 2002, and with restrictions on manure spreading in the Santa Ana region (including the former Agricultural Preserve), most manure spread on croplands is spread in the San Jacinto region (42% of total manure), with about 19% of total manure now going out of the Basin.

The manure handling practices carried out by the dairies are dictated by the type of dairy operation, size of operation, local water quality regulations, and type of off-site manure processing and utilization that is locally available to the dairies. As part of an AQMD contract study with Tetra Tech, Inc., four reports on dairy practices and controls were prepared:

Report 1: Current Livestock Waste Management Practices in the Basin
Report 2: Literature and National Program Survey
Report 3: Identification and effectiveness assessment of control options
Report 4: Recommendation of Control Options for the Basin

Figure 4 was extracted from Tetra Tech's Task 3 Report (Tetra Tech, November 2002) and shows the layout of a typical dairy production facility in the Chino Basin.

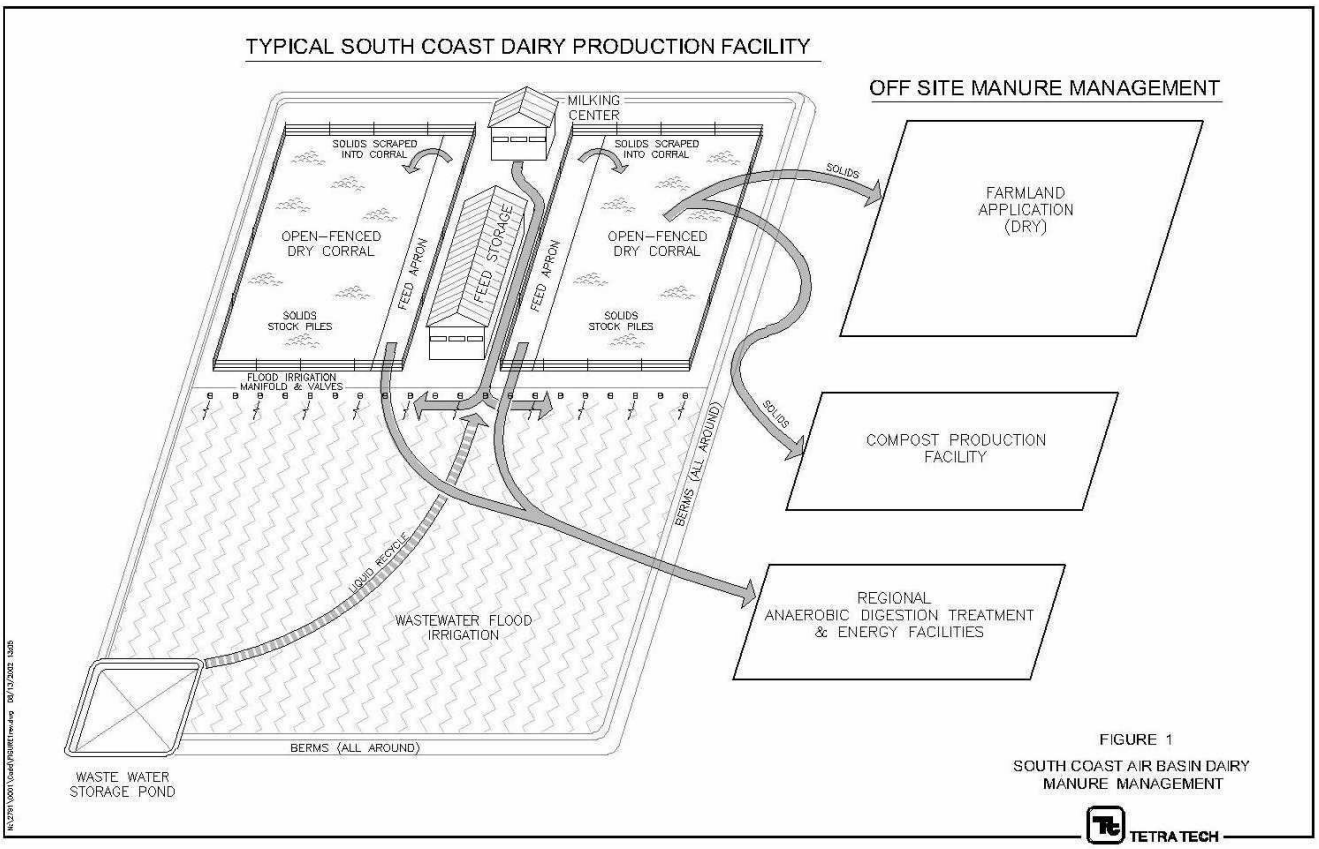

Figure 4: Typical South Coast Dairy Production Facility

The SARWQCB requirement of removing the manure from the dairies every 180 days allows for utilization of "off farm" technologies to process and/or utilize the manure. Once the manure is removed from the dairy, it can be hauled to a composter (enclosed or open windrow), digester or to an agricultural site for land application

Land application and open composting are the two main manure disposal practices currently used. Open windrow composting is the current composting practice in the Basin. There is currently one composting facility in operation which is scheduled to cease operation by the year 2006. An enclosed composter is currently being constructed in the Basin that will process a limited amount of manure.

The third manure disposal practice in the Basin is treating manure in anaerobic digesters. The Inland Empire Utilities Agency (IEUA) has built two types of digesters in the Basin; a plug flow and a complete mix digester. The biogas produced provides fuel for electric generators. The current plug flow digester utilizes wet manure and produces bio-gas to run micro-turbines and the Chino Desalter. The products are sent to a composter and the final product is sold as fertilizer. IEUA has built both types of digesters as demonstration units at their regional plants in the Basin.

EMISSIONS INVENTORY

The nitrogen in animal manure can be converted to ammonia by a combination of mineralization, hydrolysis, and volatilization. Once emitted, the ammonia can be rapidly converted to ammonium nitrate and ammonium aerosols by reactions with acidic species (nitric acid, sulfuric acid and ammonium bisulfate). Thus, the ammonia emissions contribute directly to formation of PM10 and PM2.5 in the air and can impact atmospheric visibility. Manure also emits VOCs through the processes of anaerobic and aerobic decomposition.

Source testing was conducted by an independent contractor at five dairies in the Basin during two seasonal episodes in 1995, in order to assess the air emissions of PM10 precursors from livestock waste at dairies. The testing was conducted during both the winter and summer conditions. Flux measurements were conducted to generate speciated emission factors (lbs/yr) to estimate emissions from dairy wastes. Ammonia emission factors were measured to range from 9 to 20 pounds per year per cow. In 1997, the ammonia emissions inventory for all sources was updated for the Basin (ATC 2000). As part of this update, the 1995 dairy emissions study results were re-evaluated by Dr. Eric Winegar, an author of the original study. This re-evaluation of the original flux chamber data resulted in a composite ammonia emission factor of 51 lb/head/year for milking cows.

The VOC emission factor is 12.8 lbs/head/year. This is the emission factor used by CARB and is based on a 1938 measurement study by Ritzman and Benedict. This study focused on measuring methane emissions from dairy cows using an early form of an environmental chamber. Successive literature studies have used these measurements to establish a VOC emission factor for dairy waste emissions. (In the 1997, 1999, and 2003 AQMPs, the AQMD used an emission factor of 16 lbs VOC/head/year, based on a slightly different analysis of the

data.) CARB is supporting additional dairy VOC emission studies, but the 12.8 lbs VOC/head/year emission factor is the one currently recommended by CARB.

An emission factor in terms of tons of manure was calculated for both VOC and ammonia emissions by incorporating the assumption that a cow produces, on average, 5.25 tons of manure per year. Emissions factors of 0.005 ton/year of ammonia and 0.002 ton/year of VOC per ton of manure were established.

Based on SARWQCB the dairy animal population (milking cows, dry cows, hiefers and calves) within the District has decrease from the 1993 base year amount of 514,000 head to the 2002 value of 394,000, a reduction of approximately 23%. This decrease is expected to continue as the Chino Basin becomes more urbanized. The urbanization is being driven by the annexation of the agricultural land by the cities of Ontario and Chino. At the current rate of attrition (approximately 2% per year), the dairy population is expected to be approximately 362,000 head in 2006. This corresponds to a 8% decrease from the 2002 levels.

The following assumptions were used in the emission calculations:

1. Emission Factors:
    a. Ammonia:
        i. 51 lbs/head/year (used to calculate total ammonia emissions)
        ii. 0.005 ton/ton of manure (the conversion is necessary since the analysis depends on the subsequent fate of the manure; emission factor determined by dividing total ammonia emissions per year by total manure produced)
        iii. Emission factor is for an adult cow, based on 1995 Schmidt study methodology. Emission factor for heifers and calves are reduced proportionately to the manure they produce (SARWQB estimates of 4.1 tons/year manure for adult cows, 1.5 tons/year for heifers and 0.6 tons/year for calves). [Ammonia emissions are emissions from manure only. Emission estimates do not include ammonia emitted from either the cow or cow urine.]
    b. VOC:
        i. 12.8 lbs/head/year (used to calculate total ammonia emissions)
        ii. 0.002 ton/ton of manure (the conversion is necessary since the analysis depends on the subsequent fate of the manure; emission factor determined by dividing total VOC emissions per year by total manure produced)
        iii. Emission factor is for each animal, regardless of age, per ARB's methodology. [As noted above, this is different then the 16.0 lbs/head/year factor used in the PR1127 preliminary draft staff report, the 2003 AQMP and previous AQMPs.]
    c. PM10:
        i. 1.78 lbs/head/year.
        ii. Emission factor is for each animal, regardless of age, per ARB's methodology.
2. Activity
    a. Actual animal counts from 1993 through 2002
    b. Assume a 2% decrease in cows per year from 2002 through 2010.

3. Source and destination of amount of manure removed and/or processed : SAQRWCB 2002 Annual Report Analysis

4. Emissions = emission factor x activity

Impact of Existing Manure Management Practices on Emission Reductions

As mentioned earlier, the dairies are subject to the manure handling and storage requirements of SARWQCB Order No. 99-11. The dairies are required to haul the manure off the facility within 180 days of removal from the corrals. A manifest of the manure hauled away is submitted with an annual report to the SARWCQB. The manure is sent off-site to a digester, composter, or land applied within or out of the SARWQCB Region. Table 1, from the SARWQCB, 2002 Annual Report Analysis, quantifies the percentage of the manure removed form the different dairy areas (i.e. Chino Basin, San Jacinto Watershed and the Upper Santa Ana Watershed) and the disposal location.

Table 1: Summary of Manure Handling In SARWQCB Region (2002 Report)

Manure Source / Disposal Location	Dairies in the Chino Basin	Dairies in the San Jacinto Watershed	Dairies in the Upper Santa Ana Watershed	Total
Local Cropland (on Dairy)	1.35%	1.79%	0.0%	3.14%
Local Stockpile (on Dairy)	7.27%	0.03%	0.01	7.30%
Composting facility (off dairy)	16.9%	0.0%	0.0%	16.9%
Chino Basin (land application off dairy)	9.2%	0.45%	0.0%	9.65%
Sent Out of Region*	19.2%	0.08%	0.0%	19.10%
San Jacinto Watershed (land application off dairy)	27.92%	14.11%	0.12%	42.15%
Upper Santa Ana Watershed (land application off dairy)	1.22%	0.00%	0.15%	1.37%
Total	83.28%	16.46%	0.28%	100.0%

* Out of Region refers to the SARWQCB Region

The new water quality regulation (SARWQCB Order No. 99-11) expedites the manure removal from dairies, limits and sets manure incorporation standards for land spreading of manure, and eliminates historical stockpiles of manure in and around the dairies. Because these regulations affect manure, the emissions per ton of manure must be calculated to assess

the emission reductions associated with the water quality regulations. Manure production is known from the SARWQCB's Annual Report of Animal Waste Discharge.

The estimated impact of removing historical stockpiles is calculated by multiplying the tons of historical stockpiles that have been removed (94,000 tons, according to the SARWQCB) by the emissions factor per ton of manure.

The estimated impact of the land application regulations (e.g., agronomic spreading rates, expeditious soil incorporation) is a 23% reduction in emissions multiplied by 0.5, since the reductions only occur after the manure is removed from the dairies, which occurs twice a year. The control efficiency of 23% is based, in part, on staff's review of Tetra Tech's Task 1 and Task 2 reports (see also Appendix A). Thus, the overall reduction effectiveness of the new land spreading regulations in 11.5% of the manure produced that is land applied in the Basin. 852,204 tons of manure was land applied in 2002, based on SARWQB data.

Also, in response to current and proposed water quality regulations, manure composting operations were begun in 1995. These operations process over 200,000 tons of manure per year. Based on flux results of the 1995 PM10 Technical Enhancement Program (PTEP) studies of dairy and open-windrow composting operations, emissions are 75% less at the composting operations compared to manure emissions at the dairy. Reductions from composting can only occur after the manure is removed from the dairy (twice a year), so again, the control effectiveness is multiplied by 0.5. Thus, the overall reduction effectiveness is 37.5% for manure that is composted in open windrows and near 50% for enclosed and controlled composting facilities. 226,415 tons of manure was composted in open windrows in 2002.

In response to the water quality regulations and the energy crisis, anaerobic digesters have been constructed and are currently operating. These digesters create "biogas" used as fuel for power generation equipment. The remaining digested solids are finished or near finished compost. The digester essentially eliminates VOC emission from the manure as anaerobic bacteria convert organic matter to biogas. Also, digesters require the freshest possible manure. Current digester programs scrape the feedlanes at the dairies daily and immediately transport it to the digesters. Since all the manure emissions are gone immediately (rather than waiting the 180 days until the corral is cleared), the removal factor is 1.0. Thus, the overall control effectiveness for manure sent to a digester is 99%. Demonstration projects for anaerobic digesters began in 2002, but only small amounts of manure were digested in 2002.

Of course, any manure sent out of the Basin does not contribute emissions within the airshed. Multiplied by the 0.5 removal factor to account for the manure's presence in the first 180 days, the overall effectiveness of removing manure from the Basin is 50%. 255,889 tons (about 19%) of manure was shipped out of the Basin (generally to San Joaquin Valley and Imperial County), based on 2002 SARWQCB data. (Although the Basin's boundary does not exactly match the jurisdiction of the SARWQCB and it water basins, further analysis of the SARWQCB database concerning long-range manure transport indicates that this assumption is a good one).

Emission reductions were calculated by multiplying the amount of manure removed and/or processed by the manure emission factor and a total control effectiveness. Partial emission reductions are taken for the land application of manure and windrow composting as listed under control effectiveness in Table 2. The source extent or the percentage of emission

reduction achieved due to removal from the dairy is also listed in Table 2. A 50 percent emission reduction was assumed for all manure that is removed approximately twice annually. The control effectiveness represents the percentage of emission reduction that can be achieved by the various manure disposal options.

Table 2 : Total Control Effectiveness of Current Manure Practices

Type of Disposal	Practice % Control Effectiveness	Removal Factor [0 -1]	Total % Control Effectiveness *
Land Application	23%	0.5	11.5%
Composting (open windrow)	75%	0.5	38.5%
Composting (enclosed)	95%	0.5	47.5%
Digester (plug and complete mix)	99%	1.0	100%
Manure: Sent out of Basin	100%	0.5	50%

* Total % Control Effectiveness = Practice Control Effectiveness X Removal Factor

Table 3 describes the manure disposal destinations for future years, based on historical destinations and changes in air and water regulations. Table 4 lists the emission estimates without the implementation of PR1127 (e.g. reductions due to relocation and water quality regulations). The emission reductions assume that all operations such as composting and land application are maintained at the 2002 rate in terms of percentage of manure with the exemption of the digesters. It is assumed that the digesters are on line after 2002 and that the open windrow composter ceased operation in 2005.

Table 3: Manure Disposal For Future Years

Manure Destination	2006 tons manure per year	2010 tons manure per year
Land Application in Region	937,000	835,000
Sent out of Region	256,000	256,000
Open Windrow Composting	0*	0*
Rule 1133.2 Composting	7,500	7,500
Digester (Feed Lane Cleaning)	27,400	27,400

*Current open windrow facility will close as of 2006.

*Rule 1133.2 effectively restricts open windrow composting.

Table 4: Emission Estimates (tons/day) Without PR1127

	2006 VOC	2010 VOC	2006 ammonia	2010 ammonia
Baseline	6.35	5.80	18.00	16.43
Reductions	1.37	1.31	3.89	3.72
Remaining Emissions	4.98	4.49	14.10	12.71

PROPOSED CONTROL TECHNOLOGIES AND PRACTICES

The manure handling practices carried out by the dairies are dictated by the type of dairy operation, size of operation, local water quality regulations, and type of off-site manure processing and utilization that is locally available to the dairies. An AQMD contract study by Tetra Tech included an assessment of current local waste management practices, a literature review of potential controls and practices to reduce air emissions, identification and assessment of potential local control options and recommendations. The results of the study are in the following reports (see reference section for full titles):

Report 1: Current Livestock Waste Management Practices in the Basin
Report 2: Literature and National Program Survey
Report 3: Identification and effectiveness assessment of control options
Report 4: Recommendation of Control Options for the Basin

The study by Tetra Tech, Inc. has identified the many control technologies and practices that could reduce air emissions from livestock waste. The manure handling practices are classified as "on-dairy" or "off-dairy" technologies. Based on the study, the technologies, practices or regulations that will reduce emissions and are currently applicable to the dairy practices in the Basin are the following:

1. Water Quality Regulations
2. More frequent removal of manure from dairies
3. Restrictions on amount and method of land application of manure
4. Open Composting
5. In-vessel aerated static pile composting
6. Rule 1133.2 composting
7. Anaerobic Digesters
8. Out of Basin disposal

A review of the manure management control options listed above is given in Appendix A.

The SARWQCB requirement of removing the manure from the dairies every 180 days allows for quick utilization of "off farm" technologies to process and/or utilize the manure. Once the manure is removed from the dairy, it can be hauled to a composter, digester or to a agricultural site for land application. PR1127 would increase that frequency to 4 times per year, no shorter than 60 days apart and at least one clearing in the months of November through December.

Controlled composting of manure is composting at a facility where the first stage of composting is conducted within an enclosure and emissions from the enclosure (and aeration

system, if any) are vented to an air pollution control device(s) permitted by the AQMD. Air pollution control devices include, but are not limited to, bio-filters, scrubbers, etc.

An anaerobic digester is a tank or vessel system permitted by the AQMD that excludes oxygen and in which a sludge or liquid effluent is modified by the action of anaerobic bacteria. These systems are typically used to produce methane or biogas as fuel for power generation equipment. The remaining solids from the process can be used as a soil amendment or further composted or otherwise processed.

A fabric in-vessel composter is an aerated static pile compost system that is under positive pressure and is covered by a plastic or fabric material with ventilation holes. The system consists of a containment vessel such as an elongated plastic bag which contains the composting material and uses forced aeration to maintain and control aerobic composting conditions within the bag. The forced aeration is provided by supplying air with an electric blower through perforated pipe that runs inside the full length of the bag. The raw material to be composted is placed in the bag with a compost-bagging machine. The bagger blends the compost material with required amendments and grind the material to the required size. The compost cycle is approximately 4 months. The final product can be used as compost and soil amendments. Although this type of system may meet Rule 1133.2 requirements for co-composting operations (resulting in an 80% decrease in emissions compared to open windrow composting and a total of 95% reduction from raw manure emissions), under PR1127, they would not have to meet Rule 1133.2 requirements as long as they met the PR1127 requirements for alternative manure composting operations. For the purposes of this analysis, fabric in-vessel systems are assumed to provide a 50% reduction from open windrow emissions, yielding an overall effectiveness of 88%. The 50% reduction effectiveness was assumed based on staff analysis of the emission reduction effectiveness of open aerated static piles, the PR1127 requirements that both active and curing phases of the process must occur in the enclosed vessel, and the close contact of emission gases to the composting material and water condensation on the vessel walls. Testing proposed by the Inland Empire Utility Agency, which would begin in the summer of 2004, would allow the testing of the emission reduction effectiveness. PR1127 requires the annual testing of any alternative manure composting operation. Based on these test results, staff will assess the alternative manure composting technologies. Subsequent to that analysis, staff may recommend additional performance standards and/or control equipment for these systems.

Since the other control options identified by the survey can not be sufficiently quantified at this time, they are not incorporated in the proposed rule. AQMD staff will continue supporting research and development of other potential control options.

In the absence of more specific information, the San Joaquin Valley Air Pollution Control District has assumed a default PM10 control effectiveness of ten percent for dairy BMPs in their analysis of their rule 4550.

Total Emission Reduction Impacts (With PR1127)

The control effectiveness for various manure management practices with implementation of PR1127 are listed in Table 5. The basis for calculation is the same as Table 2. The removal factor is changed to 0.75 for all practices except for the digester which remains at 1.0. The removal factor is increased to account for the increased frequency of corral cleaning to 4 times per year as required by the PR1127.

Table 5: Total Control Effectiveness of Manure Practices with PR1127

Type of Disposal	Practice % Control Effectiveness	Removal Factor [0 -1]	Total % Control Effectiveness *
Land Application	23%	0.75	17.3%
Composting (Fabric-in-vessel)	88%	0.75	66.0%
Composting (enclosed)	95%	0.75	71.3%
Digester (plug and complete mix)	99%	1.0	100%
Manure: Sent out of Basin	100%	0.75	75%

*Total % Control Effectiveness = Practice Control Effectiveness X Removal Factor

* Assume Open Windrow Composting is not available in SCAB

Table 6 describes the manure disposal destinations for future years, based on historical destinations, changes in air and water regulations, and the effect of PR1127. Table 7 lists the emission estimates with the implementation of PR1127. Table 8 lists the emission reductions that are solely due to the implementation of PR1127 (e.g., without the impact of relocation and water quality regulations). It is assumed that the amount of manure composted (now in alternative manure composting operations) and shipped out of the basin are maintained at the 2002 rate in terms of tonnage of manure and that the corrals are cleared at least 4 times per year. By 2006, it is assumed that open windrow manure composting has been phased out in the District and replaced with an fabric-in-vessel system. The analysis also assumes that the digesters are on-line and processing manure at a rate as projected by IEUA, and that remainder of the manure is sent out of the region.

Table 6: Manure Disposal For Future Years with PR1127

Manure Destination	2006 tons manure per year	2010 tons manure per year
Land Application in Region	715,000	608,000
Sent out of Region	256,000	256,000
Open Windrow Composting	0*	0*
Alternative Manure Composting (e.g. fabric in-vessel)	226,000	226,000
Rule 1133.2 Composting (enclosed)	7,500	7,500
Digester (Feed Lane Cleaning)	27,400	27,400

* Current open windrow facility will close as of 2006. Rule 1133.2 effectively restricts open windrow composting.

Table 7: Emission Estimates (tons/day) With PR1127

	2006 VOC	2010 VOC	2006 ammonia	2010 ammonia
Baseline	6.35	5.80	18.00	16.43
Reductions	2.56	2.47	7.26	6.99
Remaining Emissions	3.79	3.33	10.73	9.44

Table 8: Emission Reductions (tons/day) From PR1127 Alone

	2006 VOC	2010 VOC	2006 ammonia	2010 ammonia
Remaining Emissions Without PR1127	4.98	4.49	14.10	12.71
Remaining Emissions With PR1127	3.79	3.33	10.73	9.44
PR1127 Reductions	**1.19**	**1.16**	**3.37**	**3.27**

Comparison to WST-01 Targets and the 2003 AQMP

Table 9 compares the remaining emissions after the implementation of PR1127 to the target levels described in the 2003 AQMP control measure WST-01: a 50% reduction in ammonia and a 30% reduction in VOC from historical baseline levels. As can be seen in Table 9, emission levels after the implementation of PR1127 are below the target levels set in the 2003 AQMP control measure WST-01.

Table 9: Comparison of Remaining Emissions after PR1127 with WST-01 Target Levels (tons/day)

	VOC	Ammonia
Historical baseline emissions (1993)	10.03	25.93
"Target" emission levels	7.02	12.97
2006 Remaining Emissions With PR1127	3.79	10.73

The 2003 AQMP used a slightly different emissions methodology (e.g., different VOC emission factor, no emissions from abandoned external stockpiles). Adjusting the 2006 remaining emissions after the implementation of PR1127 to the "emissions currency" of the 2003 AQMP, remaining emissions are 4.6 tpd VOC and 8.8 tpd ammonia. This compares with 2003 AQMP WST-01 remaining emissions of 6.8 tpd VOC and 10.6 tpd ammonia in 2006.

Alternate Future Analysis

In the weeks before the release of this report, AQMD staff has received new information concerning the relocation of dairies from the District. The industry indicates that relocation may occur faster than the 2% per year assumed in the staff analysis. Although staff does not have definitive proof of faster relocation, staff has analyzed the impact of a higher rate of

relocation. This section analyzes the potential impact on the emission analysis if relocation occurs at a faster rate (~10% per year) than assumed by the staff analysis (2% per year).

According to information from Milk Producers' Council (memorandum dated April 15, 2004), CDFA data for 2003 indicates that 38 dairies and ~31,000 cows left the Southern California area during that year. By Milk Producers' Council estimates, there are currently approximately 230 dairies within the AQMD's jurisdiction. Their near-term relocation estimates are summarized in the following table:

Table 10: Near-term Local Dairy Relocation (source: Milk Producers' Council)

	# of dairies	~# in 2-5 year escrow	Remaining
Eastvale area (Riverside County)	30	30	0
City of Chino	25	22	3
City of Ontario	140	105	35
San Jacinto area	35	9	26
TOTAL	**230**	**166**	**64**

Although this data does not completely correspond to SARWQCB data and the number of dairies is not directly proportional to the number of cows, if these projections hold true, it does suggest a significant acceleration of the relocation rate of local dairies. To test the impact of such an accelerated rate of relocation (over a 75% reduction in cows by 2010), AQMD staff has re-run the technical analysis presented above assuming a 10% per year relocation rate (compared to the 2% per year in the staff analysis). The results of the alternate future analysis are presented in Table 11. As would be expected, the remaining emissions are significantly less than if relocation only occurs at a 2% per year rate. PR1127 would still produce emission reductions (e.g. 0.13 tpd VOC and 0.36 tpd ammonia in 2010) for the accelerated relocation scenario.

Table 11: 2010 Alternate Future Emissions With PR1127(tons/day)

	VOC		Ammonia	
	Current Analysis	**Alternate Future**	**Current Analysis**	**Alternate Future**
Baseline	5.80	1.38	16.43	3.91
Reductions	2.47	0.53*	6.99	1.49**
Remaining Emissions	3.33	0.85	9.44	2.42

* 0.13 tpd of the VOC reductions from PR1127

** 0.36 tpd of the ammonia reductions from PR1127

SUMMARY OF PROPOSED RULE REQUIREMENTS

A summary of the requirements of PR 1127 is provided below. A copy of the proposed Rule 1127 is included in Appendix B.

Purpose and Applicability

The purpose of PR1127 is to reduce ammonia, VOC and PM10 emissions from livestock waste, consistent with the requirements of AQMP control measure WST-01 and California Senate Bill (SB)700. Applicable operations would include dairies, heifer, and calf farms (unless exempt) within the SCAQMD's jurisdiction. It also applies to manure processing operations, such as composting operations and anaerobic digester.

Definitions

This subdivision will include new definitions added for the following terms used in PR1127:

- Alternative manure composting operation
- Anaerobic digester
- Dairy farm
- Existing dairy operation
- Manure processing operation
- Operator

Requirements

The requirements of PR 1127 apply specifically to dairy farms and the disposal of manure. There are four primary requirements: Best Management Practices, Manure Disposal Requirements, Manure Processing Requirements and Reporting/Recordkeeping Requirements.

Best Management Practices (BMP)

BMPs are required by SB700 and are proposed to reduce direct emissions and increase the emission reduction effectiveness of certain manure processing requirements. The proposed BMPs would require all farms on or after December 1, 2004 to:

1. Implement at least one of the following manure harvesting protocols to minimize fugitive dust emissions:
   a) Scrape or harrow in early morning (before 9 a.m.) only unless the moisture content is greater than 20% (as determined by specified test method); OR
   b) Clear corrals of manure such that an even surface of compacted manure remains on top of the soil. Do not scrape down to soil level. Pulling, rather than pushing, blades are recommended; OR
   c) Water corral before manure harvesting to reduce dust through increased surface moisture (this measure is not recommended for lactating cows).
2. Minimize water in corrals by
   a) Identifying and eliminating water leaks from trough and trough piping: and
   b) Complying with corral drainage standards in the Engineered Waste Management Plan.
3. Feedlanes must be paved at least eight feet on the corral side of the fence.
4. Effective January 1, 2005, clear corrals of manure in excess of 3 inches deep at least four times per year and not less than 60 days between clearings. Notification and recordkeeping are required.

5. Effective January 1, 2005, clear all on-dairy stockpiles within one month of the last corral clearing day and no more than 3 months after the date that the previous stockpiles were last completely cleared. Notification and recordkeeping are required.

Manure Disposal Requirements

On or after January 1, 2006, a dairy operator disposing of manure within the jurisdiction of the South Coast Air Quality Management District shall only remove or contract to remove that manure from their dairy to :

1) approved agricultural land within the SCAQMD; or
2) a manure processing operation approved in accordance requirements below.

Manure Processing Operation Approval Requirements

Manure processing requirements are designed to reduce ammonia and VOC emissions from unprocessed manure. Approvable manure processing operations include an anaerobic digester; or a Rule 1133.2-compliant composting facility; or an alternative manure composting facility as defined in the proposed rule. Approval procedures are described. An alternative manure composting facility must apply for approval with the SCAQMD and meet operation plan and testing requirements.

Reporting and Recordkeeping Requirements

Reporting and recordkeeping requirements are necessary to ensure rule compliance, enhance enforceability and meet certain SB700 requirements.

1) No later than January 1, 2005, the operator of an existing dairy farm shall submit a PR1127 notification to the SCAQMD, including operator's name, farm location, and contact information.
2) No later than 30 days after operations begin at a new dairy farm or an existing farm under a new operator, the operator shall submit notification to the SCAQMD, including operator's name, farm location, and contact information.
3) After January 1, 2007, an annual report is to be submitted by an operator by the 15th of January of each year. The report shall include animal population and amount of annual manure removed to various destinations.
4) Records should be maintained at the dairy farm for three years.

Test Methods

Moisture content of manure is to be determined by using an electrical conductivity moisture meter in the prescribed manner.

Fees

Operators of farms or facilities subject to reporting and recordkeeping requirements shall be assessed applicable filing and evaluation fees pursuant to SCAQMD Rule 306.

Exemptions

1) Farms with less than 50 cow, heifers, and/or calves are exempt from this rule.
2) An operator can be exempt from one corral clearing per year if conditions are such that the manure in the corral is too wet (above 50% moisture content) to remove. (Attempting to remove manure that is too wet can damage the "hard pan" layer of manure used as bedding by the cows and that serves as a barrier to percolation to ground water.)
3) Alternative manure composting operations are exempt from Rule 1133.2 requirements if they meet the minimum operating parameters for in-vessel composting.

Alternative Control Options

A person may comply with a plan for achieving equivalent emission reductions through alternative control measures. The plan must be approved by the SCAQMD, CARB and the USEPA before implementation and rule compliance.

COST-EFFECTIVENESS

Cost-effectiveness is calculated by dividing the estimated compliance costs of a proposed regulation by the estimated emission reductions. These costs were divided by the estimated emission reductions in order to obtain a cost-effectiveness estimate.

The costs that dairy operations incur to dispose of manure include a tipping fee at manure processing facilities and farms as well as transportation costs to haul the manure to the disposal locations or facilities outlined above. Table 12 shows the manure disposal costs based on a dry ton manure basis for the various disposal options. Hauling costs are on a per-ton basis and include the current related corral clearings (twice a year). The cost of additional corral clearings is assumed to be an additional $150 per farm per clearing.

Table 12: Cost of Manure Disposal Options (adjusted to tipping-fee basis)

Manure Disposal Option	Tipping Fee ($/ton)	Hauling Cost ($/ton)	Total Cost ($/ton)
Shipping in SCAB*	$1.50	$6.00	$7.50
Shipping out of SCAB (backhaul benefit**)	$1.50	$14.50	$16.00
Shipping out of SCAB (no backhaul benefit)	$1.50	$30.50	$32.00
Open Composting***	$12.00	$6.00	$18.00
Anaerobic Digestion*** (IEUA - existing)	$4.00	$16.00	$20.00
Fabric-In-Vessel Composting****	$16.74*	$6.00	$22.74*

* Milk Producers' Council

** Backhauling refers to the practice of using the return trip of a manure hauling for transporting other goods back to the dairy farmer, such as transporting feed.

***Inland Empire Utilities Agency

**** CTI System, Ag Bag International. Costs include land, machinery, bags, blowers, electricity, and labor.

The costs that the dairy farms would incur under PR 1127 is the additional cost of disposing of the manure though an alternative composting system compared to disposing of the manure by land application within the Basin and the cost of more frequent corral clearing (4 vs. 2 per year per farm). The analysis assumes that with PR1127, manure currently sent to the open windrow manure composting facility in Chino (which closes to new feedstock in 2006) will go to fabric in-vessel composting operations. In the absence of these facilities, the base case assumes that this manure will be land spread in the Basin (least cost option currently available).

The cost-effectiveness analyses uses the Discounted Cash Flow (DCF) method to compute the present value of the proposed rule's costs and the more stringent option over a 10-year period (the assumed equipment lifetime) with a 4 percent real interest rate, which gives the present value factor of 8.111. DCF cost effectiveness can then be calculated as:

$$\textit{Cost Effectiveness} = \frac{\textit{Additional Compliance Cost} \times 8.111}{\textit{PR1127 Emission Reductions}_{tons/year} \times 10 \textit{ years}}$$

Where:

1. *Additional Annual O&M Compliance Cost = ($FIV_{cost/ton}$–In-basin spreading)*tons manure + extra corral clearing costs*
   *=(22.74-7.50)*226,415+78,180*
   =$3,529,000
2. *PR1127 Emission Reductions$_{tons/yea}$ =(Annual Emission Reductions with PR1127) – (Annual Emission Reductions without PR1127)*

The annualized emission reductions for PR1127 are 423 tons/year VOC and 1194 tons/year ammonia. PR1127 cost-effectiveness, as determined by the DCF method described above, is shown in Table 13.

Table 13: PR1127 Cost-Effectiveness

Pollutant	Emission reductions	Cost-effectiveness
VOC	423 tons/year	$6,770/ton
Ammonia	1194 tons/year	$2,400/ton
Combined (VOC+ammonia)	1617 tons/year	$1,770/ton

INCREMENTAL COST-EFFECTIVENESS

Health and Safety Code Section 40920.6 requires that an incremental cost-effectiveness analysis be performed for a regulation which identifies more than one control option to meet the emission reduction objectives relative to the precursors to ozone, CO, SOx, and NOx.

Incremental cost-effectiveness is defined as the difference in costs divided by the difference in emission reductions between one level of control and the next more stringent control.

The incremental cost-effectiveness analyses use the Discounted Cash Flow (DCF) method to compute the present value of two rule options, one being more stringent, over a 10-year period (the assumed equipment lifetime) with a 4 percent real interest rate, which gives the present value factor of 8.111. For the purpose of calculating incremental cost-effectiveness only, a more stringent option would be constructing and sending manure to an anaerobic digester instead of an alternative manure composting operation. The amount of manure to be processed by either technology is assumed to be 75 tons/day or 27,375 tons/year (dry tons). This is the amount of manure currently being used at the IEUA digester.

The costs and emission reductions used in calculating the incremental cost effectiveness of a digester compared to a fabric in-vessel composting system are summarized in Table 14. For the digester, costs are listed for two scenarios; the first assumes that no electricity revenue can be used to subsidize the cost of the anaerobic digester and the second assumes that a revenue of $0.08 per KwH is realized from electricity cost savings at a facility that the digester is sited in. The first scenario is most likely if the dairy operators built a digester for control reasons, but were unable to use much of the electricity produced on site. (Currently, several regulatory and other barriers exist that prevent the sell-back of electricity to the grid, i.e., running the electricity meter backwards when producing more energy than consumed.) The second scenario is based on an IEUA-type situation where the utility can use the electricity produced 24-hours a day to reduce facility electricity costs. The two scenarios are high and low cost scenarios for local digesters. Tables 15 and 16 summarize the cost effectiveness and incremental cost effectiveness for PR1127.

Table 14:Summary of Costs and Assumptions

Costs and Assumptions	Fabric In-Vessel	Anaerobic Digester (without electricity benefit)	Anaerobic Digester (with electricity benefit at $0.08 / KwH)
Capital Costs		$8,118,700	$8,118,700
Digester Operating and Maintenance Costs	$624,000	$562,000	$(127,000)
Operating and Maintenance Costs – for the dairy (vacuum and hauling costs)		$273,750	$273,750
Capital costs + 8.111*O&M	$5,064,000	$14,900,000	$9,310,000
Absolute VOC Emission Reduction* (tons/yr)	34	51	51
Absolute Ammonia Emission Reduction* (tons/yr)	96	144	144

* compared to raw manure emissions

Table 16−Absolute Cost Effectiveness

Cost Effectiveness	VOC	Ammonia	VOC & Ammonia
Fabric In-Vessel	$15,000	$5,300	$3,900
Digester (no electricity cost recovery)	$29,000	$10,300	$7,640
Digester Scenario (recover electricity at $.08 /KwH)	$18,300	$6,460	$4,770

Table 17− Incremental Cost Effectiveness Compared to Fabric In-Vessel

Incremental Cost Effectiveness	VOC	Ammonia	VOC & Ammonia
Digester (no electricity cost recovery)	$58,000	$20,500	$15,000
Digester (recover electricity at $.08 /KwH)	$25,000	$8,800	$6,500

COST AND AFFORDABILITY

The cost of implementing PR 1127 is approximately $3.53 million per year starting in 2006. This amount is based on the increase in tipping fee from the current practices of land application to the tipping fee for a fabric-in-vessel composter and the cost of 2 additional corral clearings per year per farm. Assuming approximately 230 dairies in 2006, the average additional cost per dairy would be over $15,000 per year.

As noted in the above section, the cost-effectiveness of a digester where the recovery of electricity costs is roughly comparable to the cost-effectiveness of a fabric in-vessel composting system. However, staff could not choose to require the use of digesters in PR1127. The reasons have to do with the technical and economic nature of dairying in the South Coast. First, consider the technical nature of dairying in the South Coast. In areas where free-stall barns are used, in particular those with flushed lane systems, manure can more easily be removed, even on a daily basis. Typically, the manure-laden water from such dairies ends up in a waste lagoon on-site. In this situation, retrofitting the lagoon to capture emissions (e.g. a cover) and then venting them to a generator or control equipment is possible. Unlike dairies in other parts of the country, dairies in the South Coast are predominantly dry lot corrals. To make use of the current digester, dairies must spend extra money to vacuum up manure from their feedlanes daily to send it to the digester. This extra equipment and labor add to the cost of using a digester for a dry-lot corral dairy. Also, only about 30% of the total manure on the dairy can be captured this way. The remaining manure is deposited in the corral and must be cleared and processed in more traditional ways. For the digester scenario considered in the incremental cost-effectiveness section above, the annualized cost for a digester would be between $930,000 to $1,490,000 to process the manure from approximately 22 dairies. If the cost was imposed solely on the dairies, the cost would be $42,000 to $68,000 per dairy per year. The capital cost alone would be $370,000 per dairy.

Alternatively, consider the annualized costs to digest the same amount of manure that is currently composted (e.g., 226,400 tons/year). The cost to for the fabric in-vessel system would be $4.1 million per year. The annualized cost for a sufficient number of digesters (~8 new digesters of the capacity of the current IEUA digester) would be $7.7 million (with electricity cost recovery) to $12.3 million (with no electricity cost recovery) per year. The capital cost for that many digesters would be approximately $67 million. With the relocation of the dairies, a key issue is guaranteed feedstock for any facility with high capital costs. The fabric in-vessel systems are more scalable to variations in feedstock throughputs, since they have lower initial capital costs and the machinery is movable.

Second, consider the economics of the local dairy industry. As noted in the draft PR1127 Socioeconomic Report, over the last few year, milk production costs have exceeded the "mailbox" price that producers would get for their milk. In addition, many dairymen either lease their lands or are contemplating moving within the next two to five years. In this situation, fewer dairymen could recover the capital costs of building and operating a digester. Fabric in-vessel composting systems are scalable; fewer could be operated in later years when fewer dairies will result in less manure to be processed. Increased compliance costs to the dairy farms that would need to be absorbed by the dairy sector can not currently be passed down to consumers due to the milk pricing structure in California. Public/private partnerships between public service utilities and the dairy operators could overcome many of the economic barriers to the use of digesters. Public utilities could more easily use the energy produced by the digester for their round-the-clock operations, and thus recover some costs through energy savings. Also, the potential exists to design these digesters for multiple feedstocks, allowing the transition from manure to wastewater treatment. Staff does not, however, recommend that local utilities be required to build and operate digesters for dairy manure. Thus, although staff supports the use of digester technology, it believes that the cost impacts coupled with the cost recovery uncertainties are too severe at the present time to require their use by local dairies as the sole compliant technology because of the special technical and economic nature of the local dairies. However, a milk pricing structure that allowed individual dairies to better recover control costs and/or availability of public or private grant funding could certainly help overcome these obstacles. Staff is committed to continue to work with the local dairy industry and others toward that goal.

CALIFORNIA ENVIRONMENTAL QUALITY ACT

Pursuant to the California Environmental Quality Act (CEQA) and SCAQMD Rule110, the SCAQMD has prepared CEQA documents to analyze any potential adverse environmental impacts associated with the proposed rule. In November 2002, an initial version of PR 1127 was released to the public along with a preliminary evaluation of environmental impacts from implementing the proposed rule. This initial evaluation identified air quality and transportation/traffic as potential adverse significant impacts. As a result, a Notice of Preparation (NOP) of a Draft EA for PR 1127, including the Initial Study (IS), was prepared and distributed to responsible agencies and interested parties for a 30-day review and comment period from November 1, 2002, to December 3, 2002. Potential adverse impacts to other environmental areas were not identified in the IS. Two comment letters were received

regarding the environmental analysis in the NOP/IS during the 30-day public review and comment period. However, since the release of the NOP/IS, the project description has changed. Under the new project description, the potential environmental impacts will not be significant and, therefore, an NOP/IS is not necessary. The comment letters on the previously released NOP/IS were not responded to or included in the Draft EA. The EA is a substitute document prepared pursuant to §15252. Alternatives were not identified and evaluated because review of the project showed that the project would not have any significant or potentially significant effects on the environment (CEQA Guidelines §15252(b)(2)). In accordance with CEQA Guidelines §15105(b), the Draft EA with no significant impacts was be circulated for public review and comment for 30 days from March 30, 2004 to April 28, 2004. No comment letters were received that directly commented on CEQA issues.

SOCIOECONOMIC ASSESSMENT

The socioeconomic assessment for the proposed rule has been prepared and is released as a separate document.

OUTREACH AND PUBLIC COMMENTS

PR1127 has been in extensive rule development since 2000, beginning with a public workshop in October 2000. A PR1127 Working Group was formed and has met 9 times since March 2001. A public consultation meeting was held in April 2002. The Preliminary Draft Staff report was released in November 2002 and another public workshop was conducted on November 21, 2002. In addition to the one oral comment, staff received six written comments specific to the PR1127 Preliminary Draft Staff report or the NOP/IS.

In response to public comment on the November PR1127 proposal, staff further investigated various digester technologies and their costs, tracked SB700 development and implementation requirements as they pertain to PR1127, and began researching alternative composting technologies. In January 2004, staff released a revised PR1127 proposal, based on staff's analysis of previous comments. Staff received comments on the proposal at the February 2004 PR1127 Working Group meeting. On March 30, 2004, staff released the draft Environmental Assessment (EA) for PR1127. As part of the draft PR1127 EA, staff released proposed rule language, dated March 26, 2004. Subsequent to the release of the draft PR1127 EA, staff held a public workshop on April 22, 2004 to take public comment on the March 26th proposed rule language. Staff has received several oral and written comments stakeholder meetings and the public workshop, and written comments subsequent to the public workshop.

The first section contains responses to comment received on PR1127 since the release of the revised PR1127 proposal in January 2004. Response to comments received before 2004, including comments on the November 2002 Preliminary Draft Staff Report can be found in the next section. Responses to comments on PR1127 received after staff released the revised PR1127 proposal in January 2004 are included in the section following the next section.

Response to Comments Received Before 2004

A summary of the oral and written comments on the November 2002 PR1127 proposal that were received before January 2004 is provided below, followed by staff responses. (If a comment was received both before and after January 2004, the response to comment will be made in the Response to Comments Received After January 2004 section.)

Comment 1: Clarify the meaning stockpiles, as used in Tables 4 and 5 of the PR1127 Preliminary Draft Staff Report, and describe how the baseline emissions are determined.

Staff Response: On-dairy stockpiles are included in the per-cow emission factors. Before the 1999 water quality regulations, most of these on-dairy piles were ultimately (within one or two years on average) land spread, mostly in the Basin, or were stored in large semi-permanent stockpiles, generally off-dairy. These off-dairy, semi-permanent stockpiles were eliminated by 2002 in response to water quality regulations. Total raw manure emissions are based on the cow population multiplied by the appropriate emission factor, and in the years up through 2001, emissions from the off-dairy stockpiles. For 2002 and later years, raw manure baseline emissions are based solely on cow population multiplied by the appropriate emission factor.

Comment 2: Explain why a VOC emission factor of 16 lbs/head/year is used rather than the CARB factor of 12.8 lbs/head/year.

Staff Response: Based on further communication and clarification from CARB, staff is using the CARB-recommended 12.8 lbs/head/year VOC emission factor in this staff report.

Comment 3: Nutrition strategies (e.g. less nitrogen in the feed) could result in immediate 10 to 50% reduction in excreted nitrogen. Why isn't this option listed in PR 1127?

Staff Response: This issue was extensively discussed in PR1127 Working Group meetings. Although nutrition strategies may have emission reduction potential, the technical database is small, information is widely variable, and key issues, such as representativeness, have not been resolved (TetraTech, 2002). A current AQMD contract study with UC Davis was initiated, in part, to establish a test protocol(s) for determining the effectiveness of nutrition studies, as well as manure treatments. In addition, the impact on cow health, milk production, water quality, and other cross-media impacts have not been fully assessed at this time. AQMD staff will continue to review scientific studies on nutrition strategies, but does not believe that the emission reduction effectiveness and other impacts of these strategies is sufficiently known to include in PR 1127 at this time.

Comment 4: What is the link between PR1127 and the water quality regulations (e.g. SARWQCB Order No. 99-11)? Why doesn't PR1127 require compliance with the water quality regulations?

Staff Response: Certain control actions may both improve air and water quality. For example, SARWQCB Order No. 99-11 requires the twice-yearly removal of manure stockpiles to prevent groundwater contamination and PR1127 requires four-times-per-year removal to reduce the time the raw manure can emit emissions to the air. In this case, PR1127 goes beyond the water quality requirements to achieve additional airborne emissions. For compliance purposes, PR1127 contains certain recordkeeping and reporting requirements

that are also required by the SARWQCB. Other water quality regulations, such as flood control retention ponds, are for water quality purposes only. Thus, PR1127 does not require compliance with the water quality regulations as a whole, since certain water quality requirements do not impact air quality and others may not be sufficient to achieve more emission reductions. However, PR1127 does require compliance with certain water quality regulation requirements (e.g. stockpile removal, recordkeeping, and reporting), where appropriate to achieve the air quality objectives.

Comment 5: Does an anaerobic digester require an AQMD permit?

Staff Response: Yes. Any new digester must comply with the requirements of Regulation II – Permits and Regulation XIII – New Source Review, including Rule 1303 Best Available Control Technology (BACT) requirements. For example, the current pilot plant digesters established by the IEUA are permitted by the AQMD.

Comment 6: The definition of a controlled composting facility is not consistent with the requirements of PR 1133.2.

Staff Response: At the time of the original draft rule PR1127, the Rule 1133 series of composting rules had not been adopted. With the adoption of Rules 1133, 1133.1, and 1133.2, references to controlled composting operations have been removed from PR1127 and direct references to Rule 1133.2, in particular, have been added.

Comment 7: How do ammonia emissions contribute to PM10?

Staff Response: The link between ammonia emissions and ammonia aerosol PM10 (e.g. ammonium nitrate and ammonium sulfate) is incorporated into the air modeling conducted by the District as part of its attainment demonstration. In brief, the highly concentrated dairy areas in the central Basin (Chino/Ontario area) are downwind of the major sources of NOx and SOx located in the western (coastal) Basin. NOx and SOx react, in part, to gaseous nitric and sulfuric acids. These acids are advected over the dairy areas. Under the right conditions, ammonia from the concentrated dairies can react with the gaseous acids to form aerosol PM10 in the peak PM10 areas directly downwind of the dairies. The conditions most conducive to aerosol formation include moister days with lower inversions; these days are most frequent in the fall and early winter. A fuller description of the ambient PM10 modeling (including aerosol concentrations), inventory, and aerosol modeling (including aerosol chemistry) can be found in the 2003 AQMP, Appendix V, Chapter 2.

Comment 8: Other controls (e.g. manure treatments) or control technologies (e.g., pyrolysis) may prove to be effective. How can they be included in the rule's control options?

Staff Response: The control option assessment (TetraTech, 2002) describes a number of controls and control technologies that may prove effective. Although certain options are not sufficiently quantifiable to include as rule control options, AQMD staff realizes that future scientific and technical work may address these uncertainties. For example, certain manure treatments and nutrition strategies may prove effective in reducing VOC and/or ammonia emissions. The AQMD is supporting a contract study to identify and develop test protocols for manure treatments. This contract study will not be finished until the fall of 2004; subsequent studies would be necessary to set certification limits for the manure treatments using the testing protocol. In the interim, PR1127 includes a provision that allows the use of

alternative control options that demonstrates equivalent emission reductions. Such alternatives would have to be approved by AQMD, CARB, and U.S. EPA.

Comment 9: Moving manure from the Basin to the San Joaquin Valley and other areas will increase emissions in those areas. The rule should discourage out-of-Basin manure transport to ozone and/or PM10 non-attainment areas.

Staff Response: Staff has removed the previous rule proposal language that set a percentage disposal requirement that could have encouraged further transport of manure out of the Basin. In the current rule proposal, an additional manure disposal alternative is identified (e.g. alternative manure processing operations) that is cost-competitive with disposal alternatives such as shipping out of the Basin. Basin manure is currently used to fertilize crops in the San Joaquin Valley (about 20% of Basin manure goes out the Basin, mostly to the San Joaquin Valley) and staff analysis does not indicate that PR1127 will significantly change the amount of disposal out of the Basin. There are legitimate uses for manure outside of the Basin. Staff believes that PR1127 is neutral in relation to out-of-Basin spreading. PR1127 does contain reporting provisions that will allow the calculation of out-of-Basin manure transport in subsequent years.

Response to Comments Received After January 2004

A summary of the oral and written comments received since January 2004 is provided below, followed by staff responses.

Comment 1: PR1127 reporting and recordkeeping requirements should be as consistent as possible with water quality control board requirements. PR1127 should not reference specific water quality regulations since the water quality board is in the process of revising current regulations. AQMD and water quality board staff should work together to streamline reporting requirements to minimize the impact of duplicative paperwork on farmers. Industry representative also requested consolidated reporting.

Staff Response: AQMD staff has revised PR1127 to improve consistency with water quality control board reporting and recordkeeping requirements. PR1127 has also been revised to reference water quality regulations in general. AQMD staff proposes to work with water quality board staff to prepare joint reporting forms, where possible.

Comment 2: Industry has specific concerns about PR1127 BMPs. The option limiting scraping to before 9am is unnecessary if the manure is sufficiently moist as to reduce fugitive dust emissions. Second, the scrapping part of the manure removal equipment is designed not to dig into the manure hardpan, consistent with the proposed rule language. However, the "blade" level is not set, per se. Concerning the removal frequency, weather, crop land availability, service provider availability, and backhaul issues limit the industry's ability to ensure four removals per year. In particular, corrals cannot be cleared of rain-laden manure without damaging the manure hardpan that serves as both bedding for the cows and a barrier to the percolation of salts into the ground. Manure can only be sent to crop land during certain times after harvesting and before planting. Requiring manure removal when crop land is not available would increase costs, since land application is the lowest-cost disposal alternative. Only a few legitimate haulers (fully licensed by the DMV and CHP) currently exist, and they may not be able to accommodate the increased demand by the additional required removals. Lastly, at farms that backhaul manure in trucks that bring in feed,

stockpiles are cleared on a truck-by-truck basis, not on one specific day, as implied in the draft rule language.

Staff Response: AQMD staff has revised the proposed rule language in response to some of these comments. Requirements for corral clearing and stockpile removal have been split into two separate paragraphs. The proposed rule still requires clearing and removal 4 times per year, but acknowledges that corral clearing and stockpile removal may occur at different times. In recognition that corrals cannot be cleared without damage to the manure hardpan if the manure is too wet, an exemption provision for one clearing per year (and its related stockpile removal) has been added. The exemption is based on moisture monitoring in the corrals, with required reporting, recordkeeping, and exemption request provisions. It is staff's understanding that if in-corral stockpiles have been created, they can be cleared even if wet. Based on that information, no exemption for stockpile removal has been created, if the stockpile has been created. Staff has addressed the concern that the phased removal of stockpiles (which occurs at most farms and especially at farms that backhaul manure using feed trucks) separation of corral clearing and stockpile removal requirements and changing the proposed rule language to focus on the date of final clearing/removal (as opposed to the beginning of the process). At this time, staff has not received conclusive information concerning hauling limitations due to crop land availability and hauler availability to warrant additional proposed rule changes.

Comment 3: Future relocation rates will probably be higher than 2%/year. For example, much of the Riverside County dairy area of the Chino Basin has been developed or is in escrow. Will staff re-evaluate the relocation rate and how could this affect rule development or implementation?

Staff Response: In response to information from Milk Producers' Council in a memorandum dated April 15, 2004, staff has prepared an alternative future analysis (see above) to assess the impact of accelerated dairy relocation. Although accelerated relocation further reduces VOC and ammonia emissions in future years, staff believes that additional reductions from PR1127 are necessary and desirable to comply with SB700 and to make expeditious progress toward attaining the ozone and PM10 standards.

Comment 4: PR1127 does not meet the goal of emission reduction equity among all sources in the District. For example, Rule 1133.2 imposed expensive control requirements on biosolids composting operations. Also, staff has not maximized the emission reductions from this source. For example, PR1127 fails to capture and control emissions that occur immediately (within three days) after it has been produced by the cow.

Staff Response: PR1127 breaks important new air quality regulation ground. As noted in the background section, no previous criteria air pollution regulations for dairies or other livestock operations have been enacted anywhere. Unlike many AQMD source-specific rules, it establishes requirements on the whole facility (e.g. farm), instead of setting emission control requirements for specific pieces of equipment or specific processing operations as in other rules. PR1127 establishes best available control measures (BACM) on a whole facility to reduce PM10, VOCs, and ammonia, as well as setting requirements on where material sent from the facility is used or processed. (Traditionally, BACM is expressed as the Best Management Practices (BMPs) for agricultural sources). This is consistent with other BACM rules on existing area sources, such as Rule 403 and 1186. To control emissions that occur before the corral can be cleared would require the complete re-design and re-building of the

current dairies to free-stall and/or flushed lane configurations. The costs for such a re-design and re-building would be prohibitive.

New dairies can be designed and built to capture and control emissions from fresh manure in a much quicker manner. AQMD Regulation XIII contains New Source Review requirements for all new and modified permit units. Under SB700, new dairies are subject to permits, Regulation XIII and applicable BACT.

Comment 5: Some comments stated that emission reductions from certain digester and composting technologies may exceed current standards and that PR1127 should set the standards that would provide incentives these technologies. One comment suggested that PR1127 establish uniform manure and emission baseline and reduction standards. Other comments have expressed concerns that PR1127 does not set new performance standards for manure processing technologies (e.g. digesters, composters), as was done in Rule 1133.2 for composting operations, for example.

Staff Response: As noted in the air quality regulations background section, PR1127 is designed to fulfill only certain SB700 requirements, e.g. BACM for dairy facilities. Title V and other local permitting for equipment at dairies, as well as other confined feeding operations and crop farms, is underway. AQMD staff will also be conducting a review of its current BARCT (Best Available Retrofit Control Technology) rules that had exemptions for agricultural sources, as well as developing facility permits for certain confined animal farms. Staff does not agree that PR1127 limits manure processing technologies, as it does not prevent the BACT review of new digester and composting–related technologies. The AQMD will also be applying Regulation XIII, New Source Review, to new confined animal farms, such as new dairies. It is in the application of BACT standards through existing Regulation XIII requirements that these comments are best addressed. BACT determinations for manure processing technologies will be done in the same manner as BACT determination for other emission sources. As such, AQMD rule staff has forwarded these comments and supporting material describing specific manure disposal technologies to the AQMD's Technology Advancement Office, where BACT reviews are conducted. AQMD rule staff has also forwarded the Proposed Preliminary Draft BACT Requirements for New and Expanding Dairies in development by the San Joaquin Unified Air Pollution Control District to the BACT-review staff. AQMD staff recognizes concerns that the previous version of PR1127 may limit new technologies by too strictly identifying the sources within the dairy subject to BACT. In response, staff has removed the new dairy language from PR1127 and will rely on the existing Regulation XIII process to identify and require BACT, as is done with all other sources.

Some of the comments imply that PR1127 should set one emission standard for manure processing operations as a whole, as opposed to the current AQMD practice of establishing standards for each type of operation, i.e. composting operations and digesters. Although both types of operations process manure (or biosolids or greenwaste), they are not designed for the same results. A digester is designed to maximize methane emissions, while a composter is designed to produce a specific type and quality of compost. Indeed, digester digestate may need to be further composted and/or blended to be used in certain applications. Thus, AQMD staff does not concur that a general emission standard should be set for manure processing operations. It should be noted that composters (of any type) can comply with PR1127 manure processing operation approval requirements by meeting the standards in Rule 1133.2 and digesters (of any type) can comply with PR1127 manure processing

operation approval requirements by meeting the standards of the applicable AQMD permits (Regulations II and XIII).

The largest current open-windrow manure composting operations will no longer accept manure beginning in 2006. Sufficient digesters do not exist to handle the anticipated amount of manure, nor are any scheduled to be built. Based on staff analysis, we conclude that no new digesters or Rule 1133.2-compliant composters will be built for manure processing unless subsidized; so far we cannot identify any such sufficient available funding. Without in-Basin manure processing operations capable of handling the throughput at existing open-windrow composting facilities, farmers will maximize in-Basin landspreading (which has the least emission reduction potential), increase out-of-Basin manure transport (which would significantly increase diesel truck emissions due to lengthy haul trips), increase out-of-District emissions, or worst-case, potentially resort to illegal dumping (no emission reductions). PR1127 was designed to address these concerns and provide additional incentive for the development of new composting technologies. Staff does concur that previous versions of PR1127 do not sufficiently provide incentives for optimizing alternative manure composting operations. Staff has revised PR1127 to require PR1133.2-type source testing for these facilities and will prepare resolution language requiring staff to report back to the Governing Board on the control effectiveness of existing alternative manure composting operations and the potential for additional control (and emission reductions) from these sources.

Comment 6: Wasterwater agencies are frequently subject to AQMD enforcement actions against odors. The composting rule staff report detailed the odor complaint history associated with that source. In contrast, the PR1127 Preliminary Draft Staff Report contains only a brief reference to odors. Why are the dairy odors and odor nuisance being treated so differently by the AQMD?

Staff Response: The difference originates in state law. Health and Safety Code Section 41705(a) specifically says that Section 41705 nuisance provisions shall not apply to odors emanating from agricultural operations. This language is repeated in AQMD Rule 402, Nuisance. Although AQMD is prohibited from issuing nuisance complaints from agricultural sources, PR1127 should reduce emissions of certain odorants, such as ammonia and certain VOCs.

Comment 7: PR1127 should apply BACT under Regulation XIII to new and modified farms subsequent to the effective date under SB700, not January 1, 2005. Also, the entire dairy should be subject to BACT and BARCT; PR1127 only applies BACT to storage lagoons. Similarly PR1127 applies BARCT to corrals, feedlanes and manure disposal activities, and it should apply BARCT to all emission sources at the dairies. Lastly, PR1127 must apply the BACT requirements to new and modified dairies upon adoption.

Staff Response: To address these comments, staff has removed the requirements for new and modified dairies from PR1127. Any new and modified dairies will be addressed by the AQMD's existing Regulation XIII – New Source Review, including Regulation XIII's BACT provisions. Concerning BARCT, PR1127 applies BARCT to fugitive emission sources such as corrals, feedlanes and manure disposal activities. As part of its overall plan to implement SB700, the AQMD is conducting a review of all of its BARCT rules containing agricultural exemptions. As part of that review, AQMD staff will evaluate and determine, consistent with SB700 requirements, standards and emission limits that should apply to equipment at

agricultural operations. Once CARB establishes the definition of "large CAFs," AQMD staff will re-visit BARCT for all emission sources on the dairy as it develops the "large CAF" emission reduction permit regulation that must be adopted by July 1, 2006, as required by SB700. As noted above, any new or modified dairies will be subject to Regulation XIII, independent of the adoption date of PR1127. See also response to Comment #5 in this section.

Comment 8: New digester and manure management technologies, such as those presented by BION Dairy Corporation and Organic Power USA, Inc., could reduce dairy manure emissions to a great extent. PR1127 should: 1) create a uniform standard for release of methane and ammonia without reference to a specific technology; 2) establish a uniform baseline that is consistently applied across all applications; 3) set uniform boundary conditions from cradle to grave for the animal waste for application of the established baseline standards; 4) set uniform definitions for manure minimal percent solids, and allowable percent of inert materials, bedding and feed wastes; and 5) evaluate all BACT technology according to the same baseline and uniform standards as they impact overall emissions from dairies. The goal should be to create a level playing field for competing technologies, similar to Rule 1133.2. Technology design, analysis and testing information was also provided.

Staff Response: The most appropriate way to evaluate new dairy manure management technologies is through BACT analysis conducted for new source review. AQMD's existing Regulation XIII – New Source Review includes BACT requirements for new and modified facilities. Under SB700, new and modified dairies would be subject to New Source Review. The information and comments provided by technology providers has been forwarded to the AQMD's Technology Advancement Office for BACT review. (The San Joaquin Valley Air Pollution Control District (SJVAPCD) is also doing a BACT review for dairy-related technologies. The Proposed Preliminary Draft BACT For New And Expanding Dairies and related documents can be found on the SJVAPCD web site: www.valleyair.org under the link for "New Requirements for Agricultural Operations.") In Rule 1133.2, the AQMD staff set baseline and controlled emission standards for a single process. Existing dairies consist of several different process areas that can be quite different (or even not exist) on individual dairies. Regardless, the level playing field that you are suggesting is already embedded in our process of establishing BACT standards. Specifically, the BACT standards are established based on the technology that results in the lowest emission rates for a given process. Alternative technologies that can demonstrate equivalent emission reduction benefits are also allowed as BACT-equivalent. These comments have been forwarded to the Technology Advancement Office staff for their consideration during BACT review. See also response to Comment #5 in this section.

Comment 9: Air emissions from landfills are not addressed in either Rule 1133.2, PR1127, or any other known rule. This creates an unfair situation in that the beneficial uses of organic materials through composting or digestion are regulated while landfilling these organics is not regulated.

Staff Response: Air emissions from landfills are regulated by AQMD Rule 1150 – Excavation of Landfill Sites (adopted October 1982) and Rule 1150.1 – Control of Gaseous Emissions from Municipal Solid Waste Landfills (adopted April 1985, amended April 1998 and March 2000). Also, any new or modified landfill would be subject Regulation XIII – New Source Review.

Comment 10: AQMD should seek emission reductions beyond those that will occur from relocation. The rule should set performance standards for alternative manure composting operations and digesters. AQMD should set a "preferable" manure processing option to maximize emission reductions. Energy recovery costs should be accounted for in assessing digester impacts. We agree that the best management practices should go beyond the current water quality regulations (e.g. more frequent corral clearing and stockpile removal). Lastly, the compliance threshold for new dairies should be reduced to the 50 cow per dairy limit for exemption for existing dairies and that existing dairies that are significantly modified, including through increased herd size, should be subject to enhanced controls.

Staff Response: AQMD staff concurs that PR1127 should seek reductions beyond those occurring from relocation. In reference to performance standards for alternative manure composting operations, please see the response to Comment #5 in this section. Any new or modified digesters are subject to Regulation XIII – New Source Review and its BACT analysis. Manure is a beneficial fertilizer and soil amendment. AQMD staff received many adverse comments on earlier rule proposals that mandated the use of certain options for a set amount of manure. Restricting legal land spreading could impact crop farming operations and could encourage the use of chemical fertilizers. As to setting a rule preference between composting operations and digesters, please see the response to Comment #5. Staff has included energy recovery costs in its digester analysis (see the Incremental Cost-Effectiveness section). As noted in previous response to comments, requirements for new and modified dairies will be addressed through existing AQMD Regulation XIII – New Source Review.

DRAFT FINDINGS AND COMPARATIVE ANALYSIS

Health and Safety Code Section 40727 requires the AQMD to adopt written findings of necessity, authority, clarity, consistency, non-duplication and reference.

Necessity - State and federal health-based ambient air quality standards for particulate matter and ozone are regularly and significantly violated in the AQMD. The reduction of ammonia and VOC from PR 1127 is part of a comprehensive strategy to meet federal and State air quality standards.

Authority - The AQMD Board obtains its authority to adopt, amend, or repeal rules and regulations from Health & Safety Code Sections 40000, 40001, 40440, 40441, and 40702.

Clarity - The AQMD Board determines that PR 1127 is written or displayed so that persons directly affected by it can easily understand its meaning.

Consistency - The AQMD Board determines that PR 1127 is in harmony with, and not in conflict with or contradictory to, existing federal or State statutes, court decisions, or regulations.

Non-Duplication - PR 1127 does not impose the same requirements as any existing State or federal regulation and is necessary and proper to execute the powers and duties granted to, and imposed upon, the AQMD.

Reference - In adopting this proposed rule, the Board references the following statutes which the AQMD hereby implements, interprets or makes specific: H&S Code Sections 40001 (rules to achieve ambient air quality standards) and 40440(a) (rules to carry out AQMP).

Incremental Cost-Effectiveness Assessment - Health and Safety Code Section 40920.6 requires an assessment of incremental cost effectiveness for proposed regulations relative to ozone, CO, SOx, NOx, and their precursors. Incremental cost effectiveness is defined as the difference in control costs divided by the difference in emission reductions between the most stringent option compared with the next less costly control option. This staff report contains an incremental cost-effectiveness assessment, as required.

Comparative Analysis

Health and Safety Code §§40727.2 requires a written analysis comparing the proposed rule with existing regulations. Table 11 identifies other AQMD rules that apply to the equipment and sources subject to PR 1127. Footnotes explain the differences between PR 1127 and the other AQMD rules where relevant. As required by Health and Safety Code § 40727.2, the purpose of this analysis is to identify and compare any other AQMD or federal regulations that apply to the same operations or source type. Currently, staff has not identified existing federal regulations or AQMD requirements that apply to dairy operations with regard to VOC and ammonia emissions. Imperial County Air Pollution Control District Rule 301 requires that feedlot manure be kept between 20 and 40% moisture levels to reduce fugitive PM10 emissions. On May 20, 2004, the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) considered the adoption of Proposed Rule 4550, Conservation Management Practices, which requires PM10 BMPs for agricultural operations, including dairies. PR1127 PM10 BMPs are a subset of SJVUAPCD PR4550 PM10 BMPs for dairies. Other federal, state and local requirements not directly associated with air emissions have been summarized in the Background and Legal Authority section.

TABLE 13
Comparison Of PR 1127 And Other AQMD Rules

Rule	Equipment/Source	Analysis
112	Applies to all equipment or activities emitting air pollutants	Defines a minor violation and sets guidelines for issuance of a notice to comply
201	Equipment that may cause the issuance of air contaminants	Requires that air pollution sources obtain Permits to Construct
202	Equipment that may cause the issuance of air contaminants	Requires that air pollution sources obtain Permits to Operate
203	Equipment that may cause the issuance of air contaminants	Requires that air pollution sources comply with permit conditions
402	Any source except agricultural odors	Prohibits public nuisance caused by emissions of air contaminants

TABLE 13 (continued)
Comparison Of PR 1127 And Other AQMD Rules

Rule	Equipment/Source	Analysis
1133	Composting and chipping/grinding operations	Administrative requirements for composting and chipping/grinding operations[2]
1133.1	Chipping / grinding operations	Requirements to prevent the inadvertent decomposition during chipping and grinding activities
1133.2	Co-composting operations	Requires controls or equivalent emission-reduction practices to reduce VOC and ammonia at operations that compost biosolids and/or manure[3]
1186	Paved and unpaved roads, livestock operations (dairies)	Requires the treatment of unpaved access connections and feed lane access areas, and the cessation of grain grinding activities in certain conditions[4]
Reg. XIII New Source Review (NSR)	All new and modified permit units	NSR requirements include BACT, modeling, emission offsets, sensitive zone requirements, facility compliance, and major polluting facility requirements such as alternative analysis, statewide compliance, protection of visibility, and compliance through CEQA[5]

[2] Dairies can only send manure to composting operations that are Rule 1127 approved, per subdivision (f). One of the approval requirements is that the composting operation be registered as required in Rule 1133.
[3] Dairies can only send manure to composting operations that are Rule 1127 approved, per subdivision (f). A composting operations that is in compliance with Rule 1133.2 subdivision (d) and is registered as required in Rule 1133, is a Rule 1127 approvable manure processing operation.
[4] Rule 1186 represents primary PM10 BACM for unpaved roads and travel areas at dairies. PR1127 represents primary PM10 BACM for corral sources. Together, they represent BACM for dairy fugitive dust sources.
[5] Regulation XIII requires New Source Review for all new and modified permit units. All new and modified digesters have permit units that would be subject Regulation XIII. Permit units at new and modified composting operations would also be subject to Regulation XIII. SB700 requires permits for new and modified dairies, thus they would also be subject Regulation XIII.

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APPENDIX A –CONTROL OPTIONS

Work completed by the AQMD Livestock Waste Working Group as well as reports on the Survey of Livestock Waste Management Practices and emission factor studies that have been completed by SCAQMD contractors have aided in developing the following analysis of potential control options.

Best Management Practices

California SB 700 is one of a package of air quality bills sponsored by senator Dean Florez to remove the exemption for agricultural sources from regulatory requirements and requires, by July 1, 2006, that each Air Quality Management District or Air Pollution Control District, which is designated as a "serious" non-attainment area for various types of particulate matter to adopt an implement best available control measures for agricultural stationary sources of air pollution.

The following BMPs are proposed to reduce PM10 emissions and increase the emission reduction effectiveness of certain manure processing requirements.

i) The following manure harvesting protocols can be used to minimize fugitive dust (PM10) emissions:

   (1) Scrape or harrow in early morning (before 9am) when moisture is higher and winds are low.
   (2) Set blade level such that an even surface of compacted manure remains on top of the soil (e.g., do not scrape down to soil level). Pulling, rather than pushing, blades are recommended.
   (3) Sprinkle corral before manure harvesting to reduce dust through increased surface moisture (This measure is not recommended for lactating cows).

ii) Minimize water in corrals (e.g. better drainage, eliminate water leaks).

iii) Feedlanes must be paved at least 8' on the corral side of the fence.

iv) Clear corrals and any on-dairy stockpiles 4 times per year, with one time being between October 1 and November 30.

v) Fugitive dust BMPs for feed processing and unpaved roads/surfaces have already been implemented in Rule 1186.

Stock Pile Elimination / Reduction

In this control option, the dairy operator removes manure stockpiles more frequently than is currently practiced or prevents stockpiles altogether. Manure stockpiles on dairies have been

a common practice. Data indicates that manure stockpiles are a significant ammonia source, on the average about 10% of the total ammonia emitted from a dairy. The Santa Ana Regional Water Quality Board (SARWQCB) in 1999 adopted ordinances regulating manure management and stockpile removal. Since that time, dairies under compliance orders have removed manure stockpiles and cleaned their corrals of manure at least twice annually. Estimates indicate that 100% of the ammonia and VOC emissions would be controlled yielding a reliable net removal effectiveness for the dairy of about 10%.

The ease of implementation of this control option is relatively high. There are no capital facilities required on the part of the dairy. There exists a vibrant community of service contractors specializing in manure management services to the dairy industry that are providing all of the needed services for this option. The time scale for implementation for this alternative is immediate.

Regulatory program implementation related to this alternative is significant. Current state, SARWQCB, manure management requirements require manure stockpile cleanup and removal by the end of 2003. In areas without strong water quality requirements, air quality agencies may also implement similar regulations.

Manure Harvesting / More Frequent Corral Cleaning

In this control option, the dairy operator removes manure and urine more frequently than is currently practiced. The animal excretes the majority of its nitrogen in its urea. This nitrogen hydrolyzes rapidly into ammonia gas. To the extent that the manure and urine can be removed quickly for additional treatment, the ammonia and VOC emissions will be less. The open area of the corral is estimated to contribute an average of 61% of the overall ammonia emissions in dry lot dairy farms in southern California. Removal of the manure twice a year is estimated control up to 50% of the ammonia and VOC emissions. This results in a net removal effectiveness of VOC and NH_3 for the dairy of about 30% for corral cleaning twice yearly. Implementation of requirement to clean the corral more frequently will increase the removal effectiveness.

The ease of implementation of this control option is relatively good. There are no capital facilities required on the part of the dairy. Depending on the size of the dairy and the ultimate disposition of the manure solids, operators may need to acquire additional rolling stock that could include a tractor, collection machinery, hauling trailers, or land application equipment. Additionally, the operator may need to evaluate personnel requirements for implementation of this option. Alternatively, there exists a vibrant community of service contractors specializing in manure management services to the dairy industry that can immediately provide all of the needed services.

The time scale for implementation of this control option is immediate. There are no ramp up time requirements associated with this option. Regulatory program implementation related to this alternative is insignificant. Current state and federal manure management requirements call for manure cleanup and removal at least once every six-months. No additional other

regulatory requirements are imminent that would affect the dairy operator's manure management program. The cost-effectiveness of this control measure is estimated to be reasonable. The practices required to achieve the option's goals are achievable with only minor adjustments and a small cost increase. The implementability of this control measure is estimated to be high.

Land Application of Manure

In this control option, the dairy operator removes manure for land application to cropland as a fertilizer. Land application as a control measure can be effective. The practice should follow Natural Resources Conservation Service Conservation Practice Standard # 633- Waste Utilization. Estimates indicate that up to 50% of the ammonia and VOC emissions could be controlled yielding a net removal effectiveness for the dairy of about 22% when accomplished within the air basin. As commercial fertilizer has reduced the need for manure, the economic benefit of manure has been increasingly viewed only in terms of the direct benefit associated with the essential nutrients for crop growth. This typically is measured in terms of the fertilizer replacement value. For example, an application of 10 tons of solid beef manure to an acre of land reduces fertilizer nitrogen requirements by about 40 lbs. during the next cropping year, which would save the farmer about $10 per acre at present fertilizer prices, disregarding the cost of manure application. Utilization of manure applied to land is accomplished through microbial conversion of plant residues and wastes into usable crop nutrients. Breakdown of organic nutrient sources takes considerable time with only a fraction of the applied nitrogen being available the first year. Actual mineralization rates are difficult to determine given the fact that this is a biological process that is sensitive to temperature and moisture conditions found in the soil system. In manure, nitrogen is mostly organic and ammonium nitrogen. Organic nitrogen is a slow release nitrogen source. Ammonium N is equivalent to commercial fertilizer and, except for that lost to the air, can be used by plants in the application year. Organic nitrogen must be converted to inorganic form before plants can use it. Variable amounts of organic nitrogen are released to the soil in a plant-available form during the first cropping year after application. Organic N released during the second, third, and fourth cropping years after initial application is usually about 50%, 25%, and 12.5%, respectively of that mineralized during the first cropping season (MWPS, 1985).

- Methods of application of manure are:
  - broadcast (top dressed) with plow-down or disking, broadcast without plow-down or disking,
  - knifed (wet manure injected under the soil surface), and irrigated (liquid manure).

The greatest nitrogen response follows land application and immediate incorporation into the soil. Best management practices recommend to plow down solid manure as soon as possible to minimize nitrogen loss and to begin release of nutrients for plant use. Most losses occur in the first 24 hours after application, so the most air quality benefit occurs when manure is incorporated into the soil as soon as possible. Injecting, chiseling, or knifing liquids into the soil minimizes odors and nutrient losses to the air and/or to runoff. Nitrogen loss as ammonia from land is greater during dry, warm, windy days than during humid or cold days. Ammonia loss is generally greater during the spring and summer months. Use of manure should be

based on at least one analysis of the material during the time it is to be used. In the case of daily spreading, the waste should be sampled and analyzed at least once each year. As a minimum, the manure analysis should identify nutrient and specific ion concentrations. Where manures are to be spread on land not owned or controlled by the producer, the manure plan, as a minimum, should document the amount of manure to be transferred and who will be responsible for the environmentally acceptable use of the manure. Additional description of the practice includes:

- All manure should be utilized in a manner that minimizes the opportunity for contamination of surface and ground water supplies.
- Where manures are utilized to provide fertility for crop, forage, fiber production, and forest products, the practice standard Natural Resources Conservation Service, Conservation Practice Standard, Nutrient Management (Code 590) should be followed.
- Manures should be applied at rates not to exceed the crop nutrient requirements or salt concentrations as stated above, and should be applied at times the manures can be incorporated by appropriate means into the soil within 72 hours of application.
- The effect of Waste Utilization on the water budget should be considered, particularly where a shallow ground water table is present or in areas prone to runoff. Limit manure to the volume of liquid that can be stored in the root zone.
- Minimize the impact of odors of land-applied manures by making application at times when temperatures are cool and when wind direction is away from neighbors. Priority areas for land application of manures should be on gentle slopes located as far as possible from waterways.
- When manures are applied on more sloping land or land adjacent to waterways, other conservation practices should be installed to reduce the potential for offsite transport of manure.
- It is preferable to apply manure on pastures and hayland soon after cutting or grazing before re-growth has occurred. Reduce nitrogen volatilization losses associated with the land application of manure by incorporation within 24 hours.
- Minimize environmental impact of land-applied manure by limiting the quantity of manure applied to the rates determined using the practice standard Natural Resources Conservation Service, Conservation Practice Standard, Nutrient Management (Code 590) for all waste utilization. The manure management plan is to account for the utilization or other disposal of all animal wastes produced, and all manure application areas shall be clearly indicated on a plan map. The operation and maintenance plan should include the dates of periodic inspections and maintenance of equipment and facilities used in manure utilization. The plan should include what is to be inspected or maintained, and a general time frame for making necessary repairs.

The ease of implementation of this control option is good. Land application of manure using best management practices is currently required by state and federal laws and regulations. Compliance enforcement measures are underway by the SARWQCB. The time scale for implementation for this alternative is immediate. The status of regulatory program

implementation related to this alternative is significant. Current state and federal manure management requirements call for manure cleanup and removal at least once every six-months. Certain county ordinances regulate how manure is incorporated into cropland.

Open Aerated Static Pile

In this control option, the dairy operator removes manure and urine to ASP composting facilities within the Southern California Air Basin. As detailed in the previous section, composting via aerated static pile, emissions from composting operations can be greatly reduced. The size of the source relative to manure management is a function of the timing of manure removal from the dairy. The source size for relatively dry corral manure is about 60% while fresh or daily removal could approach 100%. ASP composting, where suction air is used, the air is typically captured and discharged through a biofilter for removal of odor, ammonia, and volatile organic compounds.

The ease of implementation of this control option is good. Composting at windrow types of facilities is underway and has been practiced by the dairy industry for many years. Implementation of ASP or enclosed ASP facilities is underway in several locations in Southern California. The time scale for implementation for this alternative is immediate and sustained. Rule 1133 regarding composting facilities was recently adopted by the AQMD. This rule moves the hierarchy of composting to ASP or enclosed ASP and away from windrow facilities.

Inland Empire Utilities Agency (IEUA) has developed a new totally enclosed ASP composting facility in Rancho Cucamonga. This facility will replace the existing co-composting facility on Chino California. The enclosed facility will primarily process biosolids and a small amount of manure.

Open Windrow

In this control option, the dairy operator removes manure and urine to open windrow composting facilities within the Southern California Air Basin. Windrow composting emissions do not result in any reduction of ammonia or VOC's. This method of composting may add ammonia and VOC burden to the air basin. The results of this feasibility assessment indicate that windrow composting does not result in emissions reductions and may aggravate emissions issues.

Rule 1133 regarding composting facilities was recently adopted by the AQMD. This rule moves the hierarchy of composting to ASP or enclosed ASP and away from windrow facilities.

Fabric In-Vessel or Covered Aerated Static-Pile

With the upcoming closure of existing co-composting facilities, there has been an increased interest in enclosed aerated static pile technology, such as fabric in-vessel (FIVs), for the organics. FIVs use the aerobic composting process as co-composting facilities to decompose organic materials. However, the FIV aerated method of composting manure would take place in an elongated plastic container or bag (see Figure 1-4), typically 10 feet in diameter and 200 feet long, which would act as a containment cell with forced aeration.

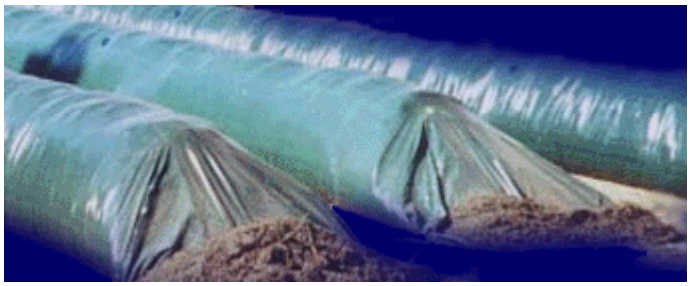

FIGURE 1-4

Fabric In-Vessel (Composting Bag)

The typical process would involve the collection of the manure before it is placed into a hopper where the manure is mixed, ground, and possibly adjusted for the proper carbon nitrogen ratio. Hoppers are designed for forklift handling, can be dumped safely from any height and are precisely balanced to tip foreward for complete discharge of contents and return to an upright position. Attached to the hopper is a hydraulic ram which is used to push the manure material through the filling chamber and compact into the plastic container or bag (see Figure 1-5). Compaction is essential to maintain porosity. Pushing the hydraulic ram forward and leaving it extended against the material will effectively leave the product sealed for aeration purposes. Retracting the ram leaves the hopper ready for another load.

FIGURE 1-5

Hopper Filling the Fabric In-Vessel

After the manure is packed into the container and sealed, the aeration pipe is attached to a timer controlled electric air blower that maintains aerobic conditions. Optimum temperature and moisture conditions are maintained by managing the blower operating time and the venting water vapor during the composing process. Each containment vessel holds approximately 200 tons of manure. It typically takes 10-14 weeks for the manure to compost.

Covered Aerated Static-Pile system by the controlled use of a PTFE membrane that is permeable to oxygen but impermeable to large molecules. In addition to the membrane, which covers the organic material during composting, the system includes a concrete floor and wall, blowers for aeration, and a winder for efficient movement of the cover. The system also requires consistent management including preparation of materials to achieve a homogenous mixture with moisture content of 55-60 percent and monitoring of temperature and oxygen levels. With this system, the composting process takes eight weeks. The "heap" of organic material is covered by the membrane, which is secured to the ground, allowed to compost for four weeks, then moved and re-covered for two weeks for stabilization. During the final two weeks of curing, the heap is uncover

Use of Anaerobic Digesters for Disposal of Dairy Waste

Anaerobic digestion (AD) is the microbial decomposition of an organic matter by microorganisms in the absence of oxygen to produce a stabilized biomass and "biogas", consisting of methane (CH4), carbon dioxide (CO2) and trace gases. The stabilized biomass (the digestate) can be separated into fiber and liquid. The fiber can be used and sold as a soil amendment. The biogas can be burned in a boiler or furnace or used to produce electricity. The liquid is rich in nutrients and can be used as a substitute for inorganic fertilizer.

Technology

AD occurs in four stages:

1. The organic plant or animal matter (proteins, carbohydrates and lipids) is decomposed (hydrolyzed) to soluble compounds such as sugar. The hydrolysis of the organic matter is the rate limiting step.
2. The soluble compounds are fermented to short chain, volatile fatty acids.
3. Acetogenesis forms hydrogen, CO_2 and acetate.
4. Methanogenesis converts the fatty acids to biogas (methane).

The acid forming bacteria are tolerant to environmental changes such as pH and temperature. In contrast, the methane forming bacteria are intolerant to environmental changes. The anaerobic digestion process is outlined in the following flow diagram.

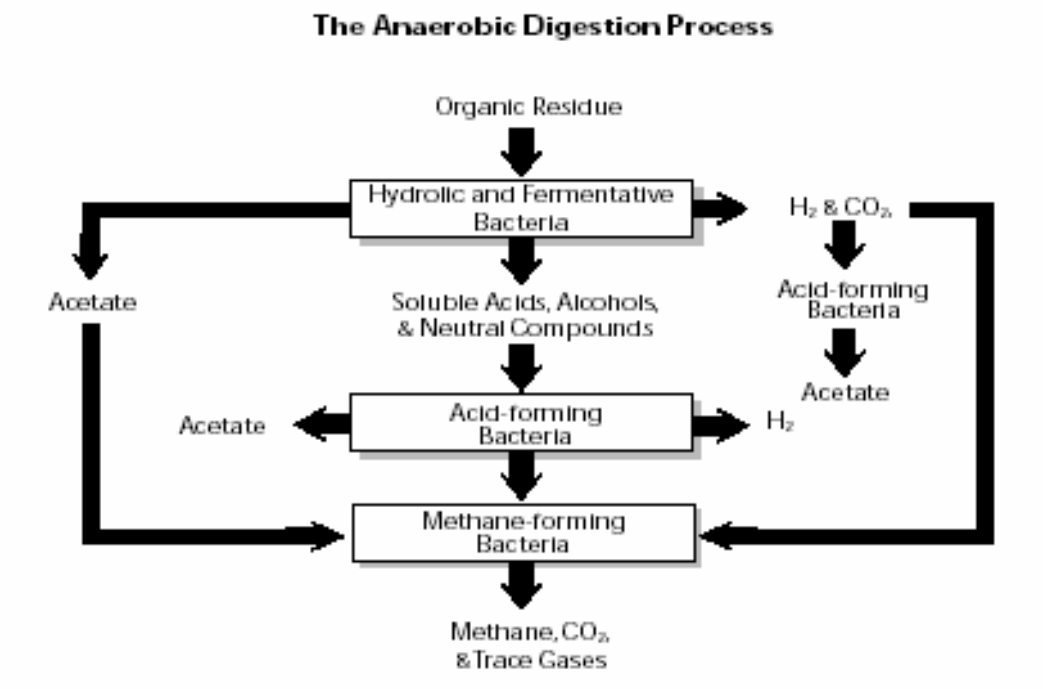

Figure 1: Anaerobic Digestion Process

Types of Digesters:

The types of anaerobic digesters include Covered Lagoon, Batch Digester, Plug-Flow Digester, Completely Stirred Tank Reactor (CSTR), Upflow Anaerobic Sludge Blanket (UASB), and Anaerobic Sequencing Batch Reactor (ASBR), and others. The complete-mix, plug-flow, and the covered anaerobic lagoon are three types of the digesters that are recognized by the USDA's Natural Resource Conservation Service (NRCS) in the form of "National Guidance provided to States." The different digester designs, all trap methane and reduce fecal coliform bacteria, but they differ in cost, climate suitability, and the concentration of manure solids that type of digester can digest.

Important factors, such as temperature, moisture and nutrient contents, and pH are also critical for the success of AD. AD can be best occurred at three range of temperatures, psychrophilic (5-15 °C), mesophilic (30-40°C) and thermophilic (50-60°C). In general, AD at mesophilic temperature is more common even though digestion at thermophilic temperature has the advantages of reducing reaction time, which corresponding to the reduction of digester volume. Psychrophilic digesters are used in colder climate areas. Moisture contents in greater than 85% or higher are suitable for AD.

The complete-mix digester is a large, vertical poured concrete or steel circular container. The manure is deliberately mixed within the digester reactor. The mixing process creates a homogeneous substrate that prevents the formation of a surface crust and keeps the solids in suspension. Today's complete-mix digester can handle organic wastes with total solid concentration of 3% to 10%. Mixing and heating improves the digester efficiency. Complete-mix digesters can be operated at either the mesophilic or thermophilic temperature range with a hydraulic retention time (HRT) as brief as 10-20 days.

The basic plug-flow digester design is a long linear chamber, often built below ground level, with an air-tight expandable cover. Organic wastes is collected daily and added to one end of the trough. Each day a new "plug" of organic wastes is added, slowly pushing the other manure down the trough. Plug-flow digesters are usually operated with a total solid concentration of 11%-13% at the mesophilic temperature range, with a HRT from 20-30 days. A mixing pit is used to prepare the manure for use in the digester. The manure total solids concentration is adjusted by dilution with water to a range of 11% - 13% in a mixing pit prior to the digestion process.

A cover lagoon is an earthen lagoon fitted with a floating, impermeable cover that collects biogas as it is produced from the organic wastes. The cover is constructed of an industrial fabric that rests on solid floats laid on the surface of the lagoon. The cover can be placed over the entire lagoon or over the part that produces the most methane. An anaerobic lagoon is best suited for organic wastes with a total solid concentration of 0.5%-3%. Cover lagoons are not heated.

Covered lagoon digester operation and maintenance is simple and straightforward compared to complete-mix and plug-flow digesters. The capital cost for covered lagoon can be less than those required for the complete-mix and plug-flow types of conventional digesters. However, a key issue for covered lagoon is that digestion is dependent on temperature, therefore biogas production varies seasonally if the lagoon is not externally heated. This means that methane production is greater in summer than in winter. In general, a daily biogas production in summer could be averaged 35% higher than in winter. This may make end-use applications more problematic than plug flow and completed mix digesters. Another concern is that it can take an anaerobic lagoon as long as 1-2 years to achieve its "steady state" biogas production potential.

Anaerobic Digestion in the Chino Basin

The Inland Empire Utilities Agency (IEUA) is a municipal water district in the Chino Basin. The IEUA supplies imported drinking water and recycled water, collect, treat and dispose of wastewater, and provides utility-related services in the Chino Basin. IEUA implemented an Organics Management Strategy program to protect the Chino Groundwater Basin from infiltration of salts, nutrients and pathogens generated by dairies to reduce future costs of removing contaminants from the groundwater.

The IEUA has developed two manure digestion demonstration projects. The IEUA digesters are centralized facilities and odeled after the Danish, community and CAD designs. The digesters serve a small cluster of 14 dairies for a total of 16,000 cows. Fresh manure is removed daily from the corral and transported to the digestion facilities. The treatment process consists of an anaerobic digester for the destruction of organic material and the production of methane gas used to provide 0.75 MW of power used to supply a portion of the power requirements of IEUA facilities. The biosolids produced by digestion are dewatered and conveyed to a composting facility, while the filtrate is discharged to the sewer line.

The two digesters are located at IEUA's Regional Plant No.1 (RP-1) and Regional Plant No.5 (RP-5) in the Chino Basin. The digester at RP1 is a complete mix digester and was built by retrofitting an existing digester used for municipal waste. IEUA plans to use this digester to co-digest manure and municipal waste. The RP-1 complete mix digester is a public-private partnership with the dairy industry to digest approximately 150 wet tons per day of manure. IEUA initially operated RP-1 in phase 1 which is the digestion of manure only. A second phase, Phase II, will be the digestion of manure and biosolids. RP-1 digester pilot project is similar in design to the Danish CAD system with potential to digest manure and municipal biosolids as well as supply biogas and/or electricity to the facility.
The initial goals of the RP-1 Pilot Project were to
:

- Demonstrate use of a complete mix thermophilic anaerobic digester technology to process a mixture of biosolids and manure.
- Supply biogas to provide additional fuel for the electric generator at RP-1
- Generate 0.25 MW of power
- Produce 30 tons per day of organic fertilizer
- Remove over 5 tons per day of salts/nitrates from groundwater in Santa Ana River Watershed

The digester at RP-5 is a plug flow digester designed specifically to process dairy manure. The plant includes feedstock mixing and heating tanks, plug flow anaerobic digester and a belt press and centrifuge for dewatering the digestate. RP-5 will digest 225 wet tons per day of fresh manure at 12-20% solids from 3,750 cow. IEUA is currently optimizing the process parameters (feedstock and operating temperature) in an effort to optimize the methane production and characteristics of the digestate. IEUA is assessing the use of food waste from the food industry (brewery and cheese) to augment the digester feedstock. RP-5 digester plant is similar to the European community digester plants since it accepts manure from local dairy operations. The electrical generated by micro-turbines is used to run a de-salter operated by IEUA in the Chino Basin. The initial goals of the RP-5 pilot project were to:

- Demonstrate plug flow anaerobic digestion technology
- Supply 210,000 cu ft/day of biogas as fuel to the gas-fired generators at the Chino-I Desalter.
- Generate 0.5 MW of power
- Produce 135 tons/day of organic fertilizer
- Prevent 4 tons/day of salts/nitrates from entering Chino Groundwater Basin watershed
- Develop practical methods for collecting and transporting fresh manure from dairy feed lots

Both of the digester pilot projects have been successful and IEUA has plans to expand the RP-5 facility and to incorporate technology modifications.

PROPOSED RULE 1127 EMISSION REDUCTIONS FROM LIVESTOCK WASTE

(a) Purpose

The purpose of this rule is to reduce ammonia, VOC, and PM10 emissions from livestock waste.

(b) Applicability

This rule applies to dairy farms and related operations such as heifer and calf farms and the manure produced on them. It also applies to manure processing operations, such as composting operations and anaerobic digesters.

(c) Definitions

For the purpose of this rule, the following definitions shall apply:

(1) ALTERNATIVE MANURE COMPOSTING OPERATION means an in-vessel composting operation that does not meet the requirements of subdivision (d) of Rule 1133.2 and that composts either livestock manure only, or manure and greenwaste amendments only. Biosolids and food waste cannot be used as feedstocks. For the purposes of this rule, greenwaste means leaves, grass clippings, weeds, yard trimmings, wood waste, branches and stumps, home garden residues, and other related organic materials

(2) ANAEROBIC DIGESTER is a tank or vessel system that excludes oxygen and in which a sludge or liquid effluent is modified by the action of anaerobic bacteria. The remaining solids from the process can be used as a soil amendment or further composted or otherwise processed.

(3) DAIRY FARM is an operation on a property, or set of properties that are contiguous or separated only by a public right-of-way, which is directly related to raising cows or producing milk from cows for the purpose of making a profit or for a livelihood. Heifer and calf farms are included in this definition of dairy farms.

(4) ENGINEERED WASTE MANAGEMENT PLAN is a plan for a wastewater management system that is designed, constructed, operated and maintained to

comply with the wastewater containment requirements of the Santa Ana Regional Water Quality Control Board.

(5) EXISTING DAIRY OPERATION is a dairy farm being operated as of (the date of rule adoption).

(6) GREENWASTE means landscape waste generally consisting of leaves, grass clippings, weeds, yard trimmings, wood waste, branches, and stumps, home garden residues, and other miscellaneous but related organic materials.

(7) MANURE PROCESSING OPERATION is an operation that receives manure from livestock operations and processes it for use. Such processing includes, but is not limited to, composting operations producing fertilizer and/or soil amendments, and anaerobic digesters.

(8) OPERATOR is any person, people, or entity that owns or operates a dairy farm or manure processing operation subject to the requirements of this rule.

(d) Best Management Practices

On or after December 1, 2004, a dairy operator shall:

(1) Use one of the following procedures when removing manure from a corral:

(A) Scrape or harrow before 9 am only unless the moisture content of the manure is greater than 20% throughout the corral, as determined by an electrical conductivity moisture meter in accordance with paragraph (h)(1); OR

(B) Clear corrals such that an even surface of compacted manure remains on top of the soil and do not scrape down to soil level; OR

(C) Water corral before manure removal to reduce dust through increased surface moisture. This measure is not required for lactating cows.

(2) Minimize excess water in corrals by:

(A) identifying and eliminating water leaks from trough and trough piping; and

(B) complying with corral drainage standards specified in the dairy's Engineered Waste Management Plan.

(3) Pave feedlanes, where present, at least 8 feet on the corral side of the feedlane fence.

(4) Effective January 1, 2005, a dairy operator shall clear any accumulated manure in excess of 3 inches in height in each corral at least 4 times per year with at least 60 days between clearings. The operator of a dairy farm shall notify the Executive Officer on the date of each clearing and keep a record of each clearing.

(5) Effective January 1, 2005, a dairy operator shall remove all on-dairy stockpiles within one month of the last corral clearing day and no more than three months after date that the previous stockpiles were last completely cleared. The operator of the dairy farm shall notify the Executive Officer on the date when the stockpiles are completely cleared and keep a record of each removal, including date(s) of removal, hauler (if applicable), and manure destination.

(e) Manure Disposal Requirements

(1) Effective January 1, 2006, a dairy operator disposing of manure within the South Coast Air Quality Management District shall only remove or contract to remove manure from their dairy to:

(A) A manure processing operation that has been approved in accordance with the requirements of subdivision (f); OR

(B) Agricultural land within the South Coast Air Quality Management District approved by local ordinance and/or regional water quality board for the spreading of manure; OR

(C) A combination of destinations in paragraphs (A) and (B).

(f) Rule 1127 Manure Processing Operation (1127 MPO) Approval Requirements

(1) A manure processing operator shall only process manure by one or a combination of the following methods:

(A) An anaerobic digester permitted by the District.

(B) A composting operation registered according to the requirements of Rule 1133 and operating in compliance with Rule 1133.2 subdivision (d).

(C) Alternative manure composting operations registered according to the requirements of Rule 1133 and operating in compliance with the requirements of paragraphs (f)(3) and (f)(4).

(2) Application Submittal and Approval Process

(A) Any person who operates a manure processing operation shall submit an application including the following information:

(i) The name and location address of the operation;

(ii) The name(s), mailing address(es), and phone number(s) of the person(s) responsible for process operations and submittal of the application;

(iii) Registration status, if applicable, in accordance with Rule 1133 requirements;

(iv) A list of AQMD permits and permit status, if applicable;

(v) For alternative manure composting operations, a manure composting compliance plan prepared in accordance with paragraph (f)(3).

(B) After the receipt of a complete application submitted pursuant to subparagraph (f)(2)(A), the Executive Officer will either approve or disapprove the application, in writing, in accordance with paragraph (f)(1).

(C) If the application submitted pursuant to subparagraph (f)(2)(A) is disapproved by the Executive officer:

(i) The reasons for disapproval shall be given to the applicant in writing.

(ii) The applicant may resubmit a compliant application at any time after receiving a disapproval notification.

(D) An approved application shall be valid for a period of three years from the date of approval and may be renewed.

(i) Applications for renewal should be submitted at least 60 days prior to the expiration date.

(ii) If all elements in the currently approved application are the same, the re-submittal may contain the information in clauses (f)(2)(A)(i) and (f)(2)(A)(ii) and a statement of no-change to the previous approved application information concerning clauses (f)(2)(A)(iii), (f)(2)(A)(iv), and (f)(2)(A)(v). Otherwise, the re-submittal must contain all the items specified in subparagraph (f)(2)(A).

(E) An approved application may be modified prior to its expiration provided an amendment request is received and approved by the Executive Officer prior to its implementation.

(3) Alternative Manure Composting Operation Plan Requirements

The operator of an alternative manure composting operation shall submit an alternative manure composting operation plan (plan), as required pursuant to clause (f)(2)(A)(v). The plan must contain the following required elements:

(A) Compost technology specifications in accordance with following:

(i) Identify the compost technology and manufacturer. Only in-vessel systems are allowed for the purposes of subparagraph (f)(1)(C).

(ii) Describe the aeration system, including blower specifications and aeration cycle.

(iii) Describe any openings in the in-vessel system, including doors, vent holes, gas permeable membranes, etc. Describe expected frequency and duration of venting through doors, vents, or other openings.

(iv) The operator shall operate in-vessel systems in compliance with conditions specified in the approved plan.

(B) Feedstock specifications and preparation in accordance with the following:

(i) Identify feedstock and projected annual throughput. Only livestock manure and greenwaste amendments are allowed for

the purposes of subparagraph (f)(1)(C). No other amendments or feedstocks are allowed.

(ii) Composting of incoming manure feedstock must begin within 2 working days of arrival on-site.

(C) Compost cycle specifications in accordance with the following:

(i) Describe length of time for in-vessel composting. Composting within the in-vessel system must occur at least 60 days from the last introduction of feedstock into the system.

(ii) Describe length of time for final curing and storage of compost. Open final curing and storage more than 2 months after removal of compost from the in-vessel system is not allowed.

(4) Alternative Manure Composting Operation Testing Requirements

(A) The operator of an alternative manure composting operation shall perform a source test in accordance with the guidelines in Rule 1133.2, Attachment A, no later than 2 months after the beginning of operations and each year thereafter.

(B) The operator of an alternative manure composting operation that has performed a source test as required pursuant to subparagraph (f)(4)(A) shall submit the results of the source test to the Executive Officer within 60 days of the completion of testing.

(5) A manure processing operator who fails to comply with an approved Rule 1127 MPO application, including an alternative manure composting plan, if applicable, shall be in violation of this rule.

(6) A manure processing operator who accepts manure for processing without an approved 1127 MPO application or renewal shall be in violation of this rule.

(g) Reporting and Recordkeeping Requirements

(1) No later than January 1, 2005, the operator of an existing dairy farm shall submit a Rule 1127 notification to the Executive Officer in writing. The Rule 1127 notification shall include:

(A) Dairy farm operator's name;

(B) Name of contact person, if different from operator's name;

(C) Farm name, if applicable;

(D) Farm street address;

(E) Farm mailing address, if different from the street address;

(F) Telephone number for the contact person.

(2) No later than 30 days after operations begin at a new dairy farm or at an existing farm under a new operator, the operator shall submit to the Executive Officer the information required in paragraph (g)(1).

(3) An operator shall submit an annual report to the Executive Officer in writing by January 15th of each year after January 1, 2007. The report shall include:

(A) Information required in paragraph (g)(1); and

(B) Animal population for the previous calendar year, broken out by number of adult cows, heifers, and calves;

(C) Amount of manure removed from the dairy in the preceding calendar year, broken out by the following destinations:

(i) agricultural lands within the jurisdiction of the South Coast Air Quality Management District;

(ii) manure processing operation(s) within the jurisdiction of the South Coast Air Quality Management District, reporting amount to each manure processing operation;

(iii) a location out of the jurisdiction of the South Coast Air Quality Management District.

(4) The dairy operator shall maintain copies of all manure manifests, tipping fee invoices, manure moisture test records, corral clearing records, and stockpile removal records, at the dairy farm for three years or for five years if the dairy farm is a Title V facility. These records shall be supplied to the Executive Officer upon request.

(5) The operator of an alternative manure composting operation shall maintain for three years all of the following records:

(A) Logs of feedstock arrival, including date and amount;

(B) Starting and ending date of each in-vessel compost cycle, and removal date of final compost; and

(C) Logs of aeration and venting events for each compost cycle.

(h) Test Methods

(1) The moisture content of manure shall be determined with an electrical conductivity moisture meter. Moisture readings shall be taken by introducing the probe three inches into the manure. All readings shall be recorded. Moisture content samples shall be taken in such a manner as to be representative of the corral or stockpile, with a minimum of 5 readings per corral or stockpile.

(i) Fees

(1) Operators of dairies or manure processing operation shall accompany the submittals required by subdivisions (f) or (g) with applicable filing and evaluation fees pursuant to District Rule 306.

(j) Exemptions

(1) This rule shall not apply to a dairy farm with less than 50 cows, heifers, and/or calves.

(2) An approved alternative manure composting operation is exempt from Rule 1133.2 if the operation is in compliance with subdivision (f).

(3) An operator can be exempted from one of the corral clearings required by paragraph (d)(4) per calendar year, if the operator meets all of the following requirements:

(A) At 60 days after the previous corral clearing, notifies the Executive Officer that the moisture content of the corral manure is above 50%, as determined by an electrical conductivity moisture meter in accordance with paragraph (h)(1).

(B) Upon notification, tests the moisture content of the corral manure at least weekly.

(i) If the moisture content of the corral manure is less than 50%, the corral must be cleared as specified in paragraph (d)(4).

(ii) If the moisture content is greater than 50%, the operator shall record the test results and keep the records required by paragraph (g)(4).

(C) If the moisture content remains greater than 50% after 90 days since the previous corral clearing, the operator shall notify the Executive Officer that the operator is claiming an exemption from a clearing required by paragraph (d)(4).

(k) Alternative Control Options

(1) In lieu of complying with the provisions of subdivision (e), a person may comply with a plan for achieving equivalent emissions reductions through alternative control measures. To be effective, such a plan shall be approved in writing by the Executive Officer, the California Air Resources Board, and the U.S. Environmental Protection Agency.